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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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TABLE OF CONTENTS

Highway Construction in the United States . . 1
Indiana Holds Secondary Road Letting 6
The Railroad as an Operator of Highway Transport. By Arthur H. Blanchard 8
Hard-surface Roads Should be at Least 18 ft. Wide 9
Careful Crossing Campaign Begun 11

EDITORIALS:

Nevada Public Service Commission Renders Grade Crossing Decision 7
Government's Expenditure for Roads Not Large 7

EQUIPMENT—TRADE—MATERIALS:

Machine for Drilling Pavement Adapted to Take Borings 10
Mixing Cement With Soil New Idea in Road Building 10
New Device Tests Road Smoothness 10
Improved Method of Screening Effects Big Saving in Materials 11
New Streets for Philadelphia 11

MEETINGS:

Calendar 12
S. P. E. E. Favors Broadening of Engineering Education 12
American Society of Civil Engineers Convenes at Portsmouth 12
C-B-H Association to Hold Convention . . . 12

PERSONAL MENTION 12

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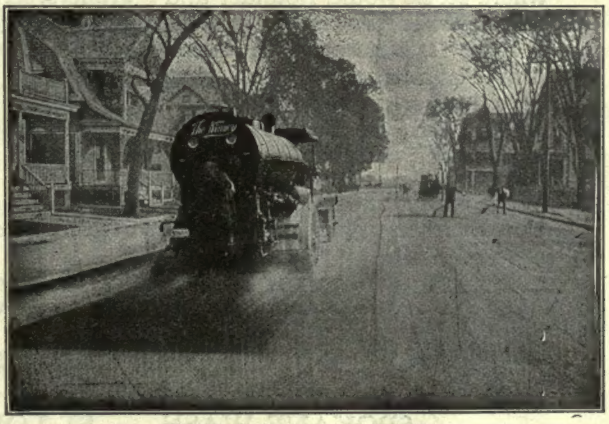

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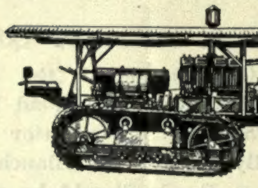

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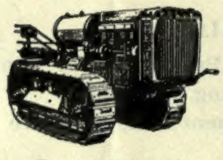

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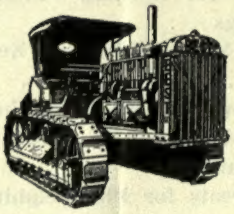

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII. NEW YORK, N. Y., JULY 5, 1922 No. 1

Highway Construction in the United States

A Review of the Work Done in 1921 and an Outline of the Construction Planned for 1922 by the State Highway Departments

It has been estimated by Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads, that the total expenditure for the construction and maintenance of roads outside of cities in this country in 1921 was about $600,000,000 and that the expenditures for 1922 will amount to $720,000,000.

Many factors have contributed to this increase in the amount of money spent on good roads. The U. S. Bureau of Public Roads has increased the scope of its activities, the state highway departments have developed into more efficient bodies, and the confidence of the public has been gained to such an extent that the raising of money to meet federal aid funds is easier of accomplishment. The rapid increase in the traffic using the highways, especially the development of shipping freight by motor truck, has given an added impetus to the good roads movement. A better understanding of the economic value of improved highways has made it easier to get the favorable vote of the people on bond issues for road building purposes and the bonds find a much readier market than they did in 1920. The decrease in the costs of construction are so marked that many highway officials feel that the low level has been reached and have decided upon ambitious programs to take advantage of the low prices. The taxpayer has been shown that a greatly increased mileage over 1921 can be built with the same amount of money. While a few states have announced policies of retrenchment, by far the greater number have programs calling for bigger expenditure and greatly increased mileage over last year.

The information contained in this article was obtained from a questionnaire sent to all the highway departments. In a few instances where the questionnaire was not returned, the figures were taken from the report of the state highway department.

Alabama

Alabama last year expended $500,236 of federal, $500,236 of state and approximately $3,300 of county funds, building 84.55 mi. of earth and gravel and 4.65 mi. of other roads. A $25,000,000 state bond issue and $2,000,000 of county bond issues were voted during the year. Motor vehicle fees amounted to $958,737. Funds available for highway work for the present year include $3,200,000 of state, $3,000,000 of federal and approximately $3,000,000 of county funds. During the present year, it is planned to build 185 mi. of earth and gravel and 115 mi. of higher type roads.

Arizona

In 1921 the Arizona State Highway Department spent about $2,000,000 on highway construction. Maricopa County early in 1922 completed the construction of highways under a $4,000,000 bond issue and let another contract for additional mileage, the funds of which are supplied by a $4,500,000 bond issue passed last year. About $3,000,000 of federal and state funds are available for work during the present season, and the program includes 300 mi. of gravel and 12 mi. of hard surfaced roads.

Arkansas

The State of Arkansas spent on highway improvement in 1921 $1,800,000 of federal, $235,000 of state, and $19,000,000 of county and road improvement district funds, and built 1,900 mi. of earth and gravel roads and 348 mi. of paved roads. County bond issues totalling $1,490,000 were voted during the year. Motor vehicle fees for 1921 amounted to $648,000. Funds available for 1922 include $3,500,000 of federal, $300,000 of state, and $12,000,000 to $15,000,000 of county funds. This will include county bond issues to the amount of $8,000,000 or $9,000,000. It is planned to construct 1,250 mi. of earth and gravel roads and 300 mi. of paved roads this year.

California

The State Highway Department of California expended for road construction last year upwards of $14,000,000. Of this amount, $1,518,359 was federal aid money and the remainder was made up from state bond issues and the state's share of the motor vehicle tax, the latter amounting to $2,916,980. Of the roads constructed, 304 mi. were earth and gravel and 352 mi. were hard surface. The amount estimated for expenditure this year includes $2,500,000 of federal aid, $12,000,000 of state, and $3,500,000 of motor vehicle funds. The state will build in 1922 approximately 392 mi. of earth and gravel and 275 mi. of paved roads.

Colorado

The State of Colorado in 1921 expended $3,440,000 of federal $1,665,000 of state and $4,380 of county funds, building 149 mi. of earth and gravel and 51 mi. of other road types. A $5,000,000 state road bond issue was passed last year. Motor vehicle fees amounted to $800,000. During the present year it is planned to construct 290 mi. of earth and gravel and 45 mi. of other types.

Connecticut

For the fiscal year ending June 30, 1921, Connecticut spent $7,127,960 of federal, state and local funds for road work. Trunk line construction included .68 mi. graded, 7.96 mi. gravel, 6.25 macadam, 2.96 mi. bituminous concrete and 1.15 mi. concrete, with 2.45 mi. gravel and .03 mi. concrete reconstruction. State aid construction included .61 mi. graded, 4.28 mi. gravel, .86 mi. stone surface, .35 mi. macadam, 5.85 mi. bituminous macadam, 1.68 mi. concrete, with .37 mi. gravel, .32 mi. macadam and .28 mi. bituminous macadam reconstruction. Motor fees collected during fiscal year amounted to $2,126,772. For the present year $3,787,000 of federal, state and local funds are available for road work.

Delaware

In 1921, the State of Delaware expended highway funds as follows: federal $244,313, state $2,611,884, and county $488,196. Only paved roads were constructed and the total was 60 mi. Bond issues for 1922 are expected to raise $1,400,000 of state and $900,000 of county funds. Motor vehicle fees collected in 1921 totalled $375,471. The state has available for 1922 $365,600 of federal, $1,400,000 of state, and $2,500,000 of county funds with which it is planned to build 70 mi. of paved roads.

Florida

In 1921 approximately $1,600,000 was expended by the state road department for construction and maintenance. Approximately $5,000,000 is available for road work during the present season. In addition to the money spent under the direction of the state road department, many of the counties are spending large sums. Close to $5,000,000 of contracts have been awarded by counties in Florida already this year.

Georgia

Last year, the Georgia State Highway Department spent $5,447,039 of federal, $1,295,525 of state and $7,164,667 of county funds completing 583 mi. of earth and gravel and 180 mi. of higher types of roads. A $75,000,000 state bond issue is contemplated. Motor vehicle fees collected during 1921 amounted to $1,703,831. For 1922 there are available $1,997,000 of federal and $2,000,000 of state funds. Approximately 426 mi. of earth anl gravel and 26 mi. of other roads are to be constructed during the present season.

Idaho

During the year 1921, the State of Idaho spent about $3,000,000 on 429 mi. of earth and gravel roads and the completion of hard surface road contracts begun in 1920. There have been built to date 40 mi. of hard surface pavement. The state legislature of 1921 voted a bond issue of $2,000,000 which was sold that year. The highway department reports total funds available for 1922 at $5,798,000 and announces a program of 685 mi. of earth and gravel roads and 15 mi. of paved roads.

Illinois

Nearly fifteen million dollars was spent on road work in Illinois last year, of which $3,802,430 was federal, $10,204,101 state and $702,207 county funds. Completed construction included 204 mi. of earth and 413.9 mi. of paved roads. Motor vehicle fees amounted to $6,803,307. For 1922, $5,743,318 of federal and $34,774,262 of state funds are available. It is planned to build this season 200 mi. of earth and 700 mi. of paved roads.

Indiana

The total expenditure of funds by the State Highway Department of Indiana for the year ending September 30, 1921, was $8,166,121. Contract payments exclusive of engineering charges for federal aid roads and bridges amounted to $3,047,038 and for state aid roads and bridges, $181,100. Maintenance of the existing 3,191 mi. of road cost $4,377,243. About 120 mi. of hard surface roads were built of which 82.5 mi. were federal aid roads. The receipts for 1921 amounted to $6,715,671 and the receipts for 1922 will be approximately the same. The construction program includes 125 mi. of hard surface pavement and about the same number of miles of the non-rigid type.

Iowa

The State of Iowa spent $38,741,627 on highway work in 1921. This sum was apportioned as follows: Federal funds, $4,403,813; state, $13,871,958; county,

$13,792,870; township, $6,672,985. The roads constructed included 1,389 mi. of earth, 843 mi. of gravel, and 168 mi. of paved roads. Motor vehicle fees collected during the year amounted to $7,742,381. There will be available for highway work in 1922, $23,638,402 and it is planned to build 1,800 mi. of earth, 900 mi. of gravel and 100 mi. of paved roads. County bond issues totalling $900,000 are contemplated this year.

Kansas

The State of Kansas in 1921 expended approximately $7,000,000 of federal, state and county funds on highway construction, building 285 mi. of various types of road. It is estimated that about $9,000,000 is available for highway work during the present year and that more than 400 mi. of road will be constructed.

Kentucky

The State of Kentucky built in 1921 217 mi. of earth and gravel roads and 169 mi. of paved roads. To do this, an expenditure of $1,403,266 of federal and $4,022,889 of state funds was made. The state raised no money by bond issues. Motor vehicle fees collected in 1921 amounted to $1,833,000. The road building program for this year contemplates the construction of 200 mi. of earth and gravel roads and 125 mi. of paved roads and involves the expenditure of $1,417,000 of federal and $3,583,000 of state highway funds.

Louisiana

More than 300 mi. of road were completed by Louisiana last year at a cost of about $6,000,000. The legislature last year passed laws creating a state highway commission and making available revenue that will amount to about $5,000,000 annually. Federal, state and parish funds available for work in 1922 amount to about $8,000,000.

Maine

In 1921, the State of Maine spent on its roads $852,192 of federal, $4,357,452 of state, and $928,525 of city and town funds. This expenditure constructed 269 mi. of earth and gravel roads and 60 mi. of paved roads. Motor vehicle taxes collected during the year amounted to $1.004,750. The state contemplates a bond issue of $1.250,000 this year. Funds available for road construction in 1922 amount to $2 074.804 of federal, $3,546,057 of state, and $900,000 of city and town funds. During the present year, construction of 232 mi. of earth and gravel roads and 40 mi. of paved roads is planned.

Maryland

The State Highway Department of Maryland reports the following funds expended and obligated in 1921: Federal, $850,000; state, $2,448,000, and county, $1,781,000. Highways actually completed during the past year include 34 mi. of earth and gravel and 124.5 mi. of paved roads. Motor vehicle fees collected in 1921 amounted to $2,451.166 and $1,600 000 was allotted to state roads. State bond issues of $3.150 000 and county bond issues of $1,500,000 are contemplated in 1922. The state will have available for work in 1922 $640,000 of federal, $1,750,000 of state and $750,000 of county funds and will build 40 mi. of earth and gravel and 130 mi. of paved road.

Massachusetts

The Division of Highways of the Department of Public Works of the State of Massachusetts expended in 1921 $675,045 of federal, $6,040,347 of state, and $2,040,347 of county and municipal highway funds and built 54 mi. of earth and gravel and 102 mi. of paved roads. The work planned for this year will total about 60 mi. of earth and gravel and 125 mi. of paved roads. It is estimated that there is available for this work $1,000,000 of federal, $7,500,000 of state and $2,000,000 of county funds. The motor vehicle fees collected in the state in 1921 amounted to $4,852,798.

Michigan

The Michigan State Highway Commission expended during 1921 $3,019,537 of federal, $13,194,878 of state and $2,607,325 of county highway funds, and constructed 558 mi. of earth and gravel, 71 mi. of macadam, and 319 mi. of paved roads. Funds available for expenditure this year are estimated at $2,225,000 of federal, $10,000,000 of state, and $2,750,000 of county funds. The construction of 537 mi. of earth and gravel, 56 mi. of macadam, and 277 mi. of paved roads is planned this season. Motor vehicle fees collected in 1921 amounted to $3,135,040. The above information applies to the work of the state highway department only and does not include county and township roads.

Minnesota

The State of Minnesota in 1921 expended $2,400,000 of federal, $11,875,000 of state and $19,014,136 of county funds. Work on the state highway system included 765 mi. grading, 1,131 mi. re-shaping, 497 mi. gravel surfacing, 885 mi. gravel resurfacing and 109 mi. of hard surfacing. Counties voted $4,250,000 of bonds and $4,000,000 of county bond issues will be voted upon this year. Motor vehicle fees aggregated $5,616,000. For 1922, $2,563,000 of federal, $10,160,000 of state and approximately $20,000,000 of county funds are available for road work. The program for work on the state highway system this year includes 386 mi. grading, 684 mi. gravel surfacing and 130 mi. of higher types of paving.

Mississippi

During 1921, the State of Mississippi spent $1,500,000 of federal and $1,500,000 of county funds, constructing 200 mi. of earth and gravel and 10 mi. of hard surfaced roads. Motor vehicle fees collected during 1921 amounted to $600,000. For the present year, $1,300,000 of federal and $2,000.000 of county funds are available.

Missouri

In 1921, a total of $6,813,529 of federal, state and county funds was expended on highway construction in Missouri, with 399 mi. of earth and gravel and 76.9

mi. of other types completed. Approximately $10,000,000 is available for highway construction during the present year and it is expected that 350 mi. of earth and gravel and 100 mi. of hard surfaced roads will be built.

Montana

In 1921, the State Highway Department of Montana expended on highways $1,450,000 of federal, $365,000 of state, and $1,565,000 of county funds and built 308 mi. of earth and gravel and 9 mi. of paved roads. Motor vehicle fees collected during the year amounted to $593,733. The program for 1922 includes 230 mi. of earth and gravel and 2.5 mi. of paved roads. The funds available include $3,300,000 of federal, $300,000 of state, and $1,300,000 of county funds. The above figures do not include work done directly by counties or by the U. S. Forest Service.

Nebraska

The Department of Public Works of Nebraska expended on highways in 1921, $1,192,000 of federal, a like amount of state, and $6,000,000 of county funds and constructed 473 mi. of earth and gravel and 16.5 mi. of paved roads. Motor vehicle fees collected during the year amounted to $2,819,628. For this year there is available $1,913,567 of federal aid which will be matched with state funds. No data is available on county funds. To April 1, the construction of 238 mi. of earth and gravel was planned for this season.

Nevada

The Nevada legislature last year reduced the state road tax from 10 to 6 ct. per $100 of valuation, which has materially decreased the amount of funds available this year. However, under the new federal aid law, Nevada gets $7.55 for each dollar it expends on federal aid roads. Last year about 35 mi. of road were completed. Approximately $2,500,000 is available for road work during the present year.

New Hampshire

Last year, New Hampshire expended $326,571 of federal and $1,833,588 of state and town funds for road work, constructing 81.16 mi. of earth and gravel and 18.57 mi. of higher type roads. Motor vehicle fees amounted to $802,311. For 1922, $365,000 of federal, $1,200,000 of state and $900,000 of town funds are available for road construction. It is estimated that 75 mi. of gravel and 25 mi. of hard surfaced roads will be constructed during the present year.

New Jersey

In 1921, the State of New Jersey spent $509,371 of federal, $10,146,681 of state and about $4,000,000 of county highway funds. There were completed during the year 225 mi. of hard surfaced roads and 113 mi. of gravel and cinder roads. The legislature of 1922 voted a $40,000,000 bond issue which will have to be approved by the people this fall and will then become available in January, 1923. The motor vehicle fees collected during 1921 amounted to $4,029,971. Funds available for highway work this year include: Federal aid balance from previous year, $825,135; federal aid allotted 1922, $942,870; state, including $7,000,000 to be furnished by counties under the reimbursement act, $8,800,000. No figures on county funds are available. The paving of 143 mi. of road has been planned by the state highway department for this year. No gravel or earth construction is contemplated in the state highway system.

New Mexico

The State of New Mexico last year expended approximately $3,000,000 of federal, state and county funds for the construction of 700 mi. of roads of various types. For 1922, about $3,500,000 is available for highway construction and it is planned to construct several hundred miles of road, mostly earth and gravel.

New York

The state highway system of New York was increased in 1921 by 632 mi. of paved roads. The total expenditure of the highway department for construction, reconstruction, and maintenance was $28,775,806. Only $6,493,130 of this amount was derived from federal appropriations. With $2,000,000 of state funds distributed among the counties and the counties' share of the automobile tax, 1,143 mi. of hard surface town highways and county roads were improved during 1921. The department plans to construct 516 mi. of hard surface road during 1922. For this work, it has recommended the appropriation of about $12,000,000 of state funds. The federal aid allottment for 1922 is $3,696,447. County funds and existing balances will furnish the remainder of the required amount.

North Carolina

The State of North Carolina expended in 1921 $7,313,000 of state funds in highway work and constructed 381 mi. of earth and gravel and 86 mi. of paved roads. The 1922 program calls for the construction of 600 mi. of earth and gravel and 400 mi. of paved roads. The amount of money available for this work includes $1,709,330 of federal aid and approximately $20,000,000 of state funds. North Carolina collected motor vehicle fees in 1921 to the amount of approximately $3,000,000.

North Dakota

The State of North Dakota built in 1921, 380 mi. of earth, 50 mi. of gravel, and 2 mi. of concrete roads and expended $1,396,978 of federal, $339,400 of state, and $1,275,932 of county funds. The program for 1922 includes grading and draining 536 mi. and surfacing 73 mi. of earth and gravel roads. It is estimated that there will be available for this work $2,000,000 of federal, $210,000 of state, and $1,500,000 of county funds. The motor vehicle fees collected in 1921 amounted to $683,052.

Ohio

In 1921, the State of Ohio expended highway funds as follows: Federal, $4,149,835; state, $11,537,627;

county, $14,134,996. All roads constructed were paved roads and totalled 1,035 mi. The state raised no money by bond issue. The motor vehicle fees collected in 1921 amounted to $7,000,000. Funds available for 1922 include $3,000,000 of federal, $5,000,000 of state and $10,000,000 of county funds. No estimate of mileage to be constructed has been announced.

Oklahoma

In 1921, the State of Oklahoma spent $1,608,360 of federal aid, $1,614,821 of state, and $2,814,084 of county funds on road work building 153 mi. of gravel roads and 82 mi. of other surfacing. County bond issues passed last year and now available amount to $3,995,000. Contemplated county bond issues total $8,425,000. In 1921, motor vehicle fees amounted to $2,005,000. For the present year, there are $1,800,000 of federal, $2,438,197 of state and $2,923,016 of county funds available. This year's construction program embraces 142 mi. of gravel and 85 mi. of hard surfaced roads.

Oregon

The report of the Oregon Highway Commission does not include expenditures of forest road funds or by counties direct. It shows expenditures in 1921 of $2,181,956 of federal, $14,613,557 of state, and $629,411 of county highway funds. Work completed includes 450 mi. of grading, 434 miles of surfacing of earth and gravel roads, and 156 mi. of paved roads. The state's share of the motor vehicle fees collected in 1921 amounted to $1,624,983. There is available for 1922, $2,012,006 of federal, $10,521,183 of state, and $5,000,000 of county funds. The 1922 program contemplates the grading of 250 mi. and the surfacing of 300 mi. of earth and gravel roads and the construction of 70 mi. of paved roads.

Pennsylvania

Close to fifty million dollars was spent by Pennsylvania on road work in 1921, divided as follows: State funds, $34,372,847; federal funds, $5,356,197; county funds, $4,993,265; local funds, $3,266,873. A total of 678.5 mi. of paved highways was built. Motor vehicle fees collected totalled $9,310,447. For 1922, there are $4,098,999 of federal funds and $7,170,917 of state funds available.

Rhode Island

During 1921 the State of Rhode Island spent $248,741 of federal and $1,656,518 of state funds on road construction, completing 2.6 mi. of earth and gravel and 35 mi. of other type of roads. Motor vehicle fees amounted to $773,151. For the present year there are available $420,625 of federal, and $1,819,000 of state funds. It is planned to construct 43.5 mi. of paved road during the present season.

South Carolina

The report of the South Carolina State Highway Commission shows that $3,485,309 was spent during 1921 under the department's supervision and 492 mi. of road was built. Counties constructed on highway system independent of state highway department 290 mi. of road at a cost of $1,510,000. Of all roads constructed, only 30 mi. were hard surfaced. The estimated value of work to be done by the state highway department in 1922 is $5,429,906 and the counties are expected to spend independently $2,250,000. This work includes 218 mi. of road not completed last season, 186 mi. which has been definitely planned for, and other work still to be planned for. Gross receipts from motor vehicle fees in 1921 amounted to $2,061,727.

South Dakota

The South Dakota Highway Department expended in 1921, $4,733,257 of federal and state funds for construction work and the counties levied $6,956,714 for construction and maintenance. The actual expenditures by counties and the mileage built is not available. The state built 660 mi. of earth and gravel roads last year and expects to build about 600 mi. this season. No paved roads were constructed in 1921 and none are planned for this year. It is estimated that $2,500,000 of state and federal funds will be available for 1922. Data on county funds is not available but the amount will be less than last year. Motor vehicle fees collected in 1921 amounted to $720,750.

Tennessee

The State of Tennessee expended on highway construction in 1921, $2,261,913 of federal funds and a like amount from state and county funds on a 50-50 basis. The state has built to the end of 1921 50 mi. of earth and gravel and 405 mi. of paved roads. It is planned to add to this total this year 25 mi. of earth and gravel and 160 mi. of paved roads. Federal aid allowances for 1922 will give the state $2,746,153 and that amount will be matched by state and county funds. The fees on motor vehicles collected in 1921 amounted to $1,387,374.

Texas

The State of Texas has no funds available for road building except 50 per cent of the motor fees which amounted in 1921 to $1,865 079 and has to depend on the county bond issue, for money to meet the federal aid. Federal aid funds expended in 1921 totalled $5,972,440 and the county bond issue, amounted to $25,000,000. About 976 mi. of earth and gravel roads and 103 mi. of paved roads were constructed. The funds available for 1922 include $12,009,750 of federal, $5,585,225 of state, and approximately $40,000,000 of county funds. This amount is sufficient, it is estimated, to build 2,500 mi. of earth and gravel and 700 mi. of paved roads.

Utah

Total expenditures in Utah for road building in 1921 were $2,601,855 and 177 mi. of earth and gravel and 25 mi. of paved roads were completed. Motor vehicle fees collected during the year amounted to $478,473. Federal aid funds available for the present year total $2,278,440 and state and county funds add

$1,249,721. The program of road construction includes 136 mi. of earth and gravel and 48 mi. of hard surface roads.

Vermont

During the past year, Vermont expended $1,345,000 of federal, $1,080,000 state and $310,000 local funds in highway construction and maintenance. Approximately 120 mi. of earth and gravel and 23 mi. of higher type paving were constructed. Motor vehicle fees amounted to $612,416. For the present year approximately equal amounts will be available for road work as were available last year. Work done under local supervision, and not included above, amounts to about $500,000 annually.

Virginia

The report of Virginia state highway work for the period from Oct. 1, 1920, to Oct. 1, 1921, shows the following funds expended: Federal, $990,958; state, $4,385,165; state and county, $1,905,899. The highways built included 329.5 mi. of earth and gravel and 200 mi. of paved roads. In addition, 51.5 mi. of earth and gravel roads were reconstructed and 939 mi. of paved roads. The portion of the motor vehicle fees which was applicable to road work amounted to $1,970,702. The funds appropriated for highway work in 1922 are: Federal, $1,456,828; state, $3,232,350; county, $700,000.

Washington

The Supervisor of Highways of Washington reports the expenditure during the past year of $843,200 of federal, $7,855,720 of state, and $13,354,050 of county highway funds, and the construction of 913 mi. of earth and gravel and 128 mi. of paved roads. The program for 1922 for state road construction contemplates the building of 110 mi. of earth and gravel and 76 mi. of paved roads. Funds available for the work include $1,103,710 of federal, $6,280,242 of state, and $10,527,120 of county funds. The State of Washington collected in motor vehicle fees in 1921 $4,000,300.

West Virginia

During the fiscal year ending June 30, 1921, West Virginia spent $1,029,320 of federal, $392,474 of state and $6,491,552 of county funds for highway construction, building 158 mi. of earth and gravel and 67 mi. of higher types of road. The state passed a $15,000,000 bond issue. Motor vehicle fees amounted to $1,164,394. For the present fiscal year $802,000 of federal, $4,000,000 of state and $5,000,000 of county funds are available for construction work. Early in April of this year the state had under contract 76 mi. of earth and gravel and 144 mi. of other roads.

Wisconsin

The State of Wisconsin expended a total of $29,124,989 for road work in 1921, of which $3,192,295 were federal funds, $4,074,110 state funds and $21,868,584 county funds. Work was done on 3,203 mi. of gravel and 403 mi. of other types. Motor vehicle fees totaled $3,650,029. For 1922 a total of $20,151,000 of federal state and county funds is available for highway construction, and work will be done on 2,450 mi. of earth and gravel and 460 mi. of other roads.

Wyoming

In 1921, the Wyoming State Highway Department expended $2,500,000 of federal, state and county funds for highway construction and maintenance, most of the construction work being grading and gravel surfacing. For the present year a similar amount is available for highway work.

INDIANA HOLDS SECONDARY ROAD LETTING

The Indiana State Highway Commission on June 23 opened bids for surfacing parts of 29 roads in 19 counties of that state. The total mileage considered for improvement is 78 mi., involving an expenditure of approximately $175,600, and is the largest single letting by the commission for improving secondary roads. According to John D. Williams, Director of the Indiana Highway Commission, it is a part of the commission's program to spend about $1,500,000 in 1922 for improvement of secondary roads in the state road system. Competitive bidding was spirited and there was an average of three proposals on each of the 29 projects. Two types of surface pavement were considered, bituminous macadam and bituminous surface treatment.

Indiana is rich in native road building materials such as stone and gravel, and the commission is agreed with Governor Warren T. McCray, who since taking office has manifested a most active interest in the good roads program, that much of this state's secondary roads should be built of these materials. It is the commission's plan to make trunk lines or market highways of rigid types, brick or concrete, thus establishing sufficient mileage of all-year type roads to handle the traffic problems of the state and particularly to make markets accessible to agricultural producers in winter as well as in summer.

The bids for maintenance on secondary roads developed some interesting facts. The total proposals received on work considered ran $18,407.16, or 9.5%, under the engineer's estimate. This demonstrates that Indiana is getting its state road work done at the minimum price consistent with quality thoroughfares. Competition was spirited with many contractors submitting proposals considerably lower than estimates which were compiled on current prices for materials and labor. Contractors from several states submitted proposals for the work.

Official figures of the Minnesota Highway Department show that only about ten cents of each 1921 and 1922 highway dollar is spent on paving. More than 90 per cent of the highway fund is being used for maintenance, gravelling, grading, bridges and similar work so as to distribute the benefits widely over the 7,000-mi. system.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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NEVADA PUBLIC SERVICE COMMISSION RENDERS GRADE CROSSING DECISION

On April 25, 1922, on the application of the Nevada State Highway Department, the Public Service Commission of Nevada held a hearing on the matter of elimination of grade crossings on the state highway system. All rail carriers in Nevada and the highway department were represented at this hearing and evidence produced by both parties was placed before the commission for the purpose of securing an opinion fixing a uniform rate of participation for the carriers on grade-crossing elimination. On June 14, the commission rendered its opinion and fixed a uniform rate for carriers of not less than 33 1-3% of the total cost of elimination. Each case is to receive special consideration but the above rate is the minimum.

In rendering this opinion, the commission was confronted with a suggestion of the highway department that the railways bear 50% of the cost and the proposal from the rail carriers that the rate should be 12½ or 25%. The commission took into account the financial condition of the state, the substantial help it receives from the federal government and the highway program extending over a period of 10 years and decided that the 50% participation was too high. The larger amount proposed by the carriers seemed too low in view of the monetary damage saved the railways by the elimination of dangerous crossings. It was brought out further in the report that the number of crossings involved from best figures available now is 52. The elimination of 52 crossings in 10 years would make an average of 5 per year and that would not seem to impose a serious burden on any one line.

The following paragraphs from the report of general interest, bearing as they do on points of conflict between highway transport and the railroads:

"They (the railways) complain that the state and national highway construction program is of no benefit to them; that in fact it will be detrimental because it will afford a competitive route for private and public automobile transportation; that, through the property taxes paid, their participation in the cost of highway construction and maintenance is heavy and that it goes to the benefit of their competitors. We must keep in view, however, that, in so far as automobile transportation results in an improvement in the art of rendering service, the public is entitled to the benefits thereof, subject to adequate regulation and taxation of these instrumentalities. On the other hand, the enlarged freight and passenger traffic and revenues flowing to the railroads from the enlarged use of auto truck and stage lines is not of record, and, while it cannot be estimated at this time, the assumption is that these transportation agencies will give to the railroads as much or more revenue than they have taken from them, provided, however, that reasonable regulation is made against the paralleling of short-line railroads where the population and the traffic are small and the latter is necessary for the support of the railroad.

"The carriers undertake to support their position in this proceeding by the contention that they pay from 1-2 to 2-3 of the total taxes in certain counties and an average of 38% of all taxes paid by all property in the state. This position is seemingly untenable, for there is no constitutional power, either national or state, under which an assignment of benefits can be allocated to a given class of property in proportion to the involuntary obligation which has been levied against it for the support of the government. To hold otherwise is to say that property shall benefit in the exercise of governmental rights and privileges in proportion to the volume of taxes paid by each class, a wholly un-American classification of property and a restriction of the rights and liberties of individuals under our form of government."

GOVERNMENT'S EXPENDITURE FOR ROADS NOT LARGE

The sum of $50,000,000 looms up in an imposing manner, even in a great country like this, as an item of expenditure, but when a comparison of this sum to be spent for road work by Uncle Sam during the coming fiscal year is made with the total military and naval expenses of $2,772,000,000, it seems pitifully small, especially when it is considered that military and naval expenditure is an economic waste, while money spent for road building pays large dividends.

The Railroad as an Operator of Highway Transport[*]

By ARTHUR H. BLANCHARD[†]

One of the objects of the National Highway Traffic Association is to develop the economic efficiency of highway transport. This association, which is independent in its findings and composed of all classes of men interested in highway transport and traffic regulations, should look into the future and endeavor to formulate guiding principles and policies which will enable the highway link in our transportation system to be developed on sound business basis in the interests of the public welfare.

What is the present attitude of railroad officials in this country towards the development of highway transport? The answer is not a simple one to formulate as many diverse opinions have been expressed in words and actions. Some of our railroad officials appreciate the intrinsic value of highway transport and have made it part of their own systems. Others have advocated its development because they have appreciated the fact that it is necessary to the success of their business that facilities should be provided for economically transporting goods over highways to be later carried by railways. Others have been concerned regarding the development of highway transport from the standpoint of destructive competition with railroad transportation and have endeavored to curtail its development through legislative action. Others, and it is hoped that there are only a few in this class, have considered the subject from such a narrow viewpoint that they have advocated the curtailment of highway improvement.

The railroads can render valuable service to the public and to themselves by helping to develop highway transport as a feeder to rail lines and as an extension of the rail service. The railroads can afford to assist in the working out of this problem, for some of the basic principles of the economical utilization of highway transport will have been solved only when highway transport service is used to efficiently expand the territory tributary to the railroad lines, to solve the terminal congestion problem, and to relieve car shortage by taking care of the short haul which is now most expensive for the rail lines themselves. A correct and immediate solution of the inter-relationship between these two links of our national distribution system is very desirable in the interests of all concerned. By no means can the railroads afford to ignore the interest they have in the efficient establishment of highway transport as an auxiliary to railroad transportation.

What are the opportunities for the railroad to function as an operator of highway transport?

First, inter-terminal transportation of freight by motor trucks. The advantages of the utilization of highway transport in this connection have been appreciated by railroad officials. It has been established in some cities, the most notable example being in the case of Cincinnati.

Second, intra-terminal and freight yard highway transport. It is believed that the utilization of motor trucks by railways in transferring commodities, especially l.c.l. freight, from cars to shipping platforms and warehouses would materially expedite the delivery of freight and would reduce idle time of cars standing on sidings.

Third, the collection and delivery of freight in municipalities and adjoining areas. This phase of highway transport, if used by railroads, would be a partial development of what is commonly known as the store door delivery plan. The ruling of the Interstate Commerce Commission in the case of the Baltimore development along this line may mean that it is impracticable for railroads at present to utilize highway transport in this manner except on such a large scale that the charge of discrimination in services rendered could not be brought against them. In England, we find a working illustration of railroads functioning as operators of highway transport in this field. One of the most notable examples in the case of the London and Northwestern Railway's comprehensive system of freight delivery by motor trucks in areas with headquarters at London, Birmingham, Manchester, Liverpool and Leeds. This railroad established this service in 1905 and in 1920 was operating over 350 motor vehicles.

Fourth, extension of transportation service through the medium of motor truck and motor bus routes. There are several methods of development practicable in this field. Urban and interurban electric railway lines may logically expand their passenger transportation facilities through the establishment of tributary motor bus routes. An illustration is afforded by the case of the Akron street railway's acquisition and operation of a fleet of motor buses to supplement their traction system.

Steam railroads may enter this field through the development of intercity and rural motor express lines to carry both commodities and passengers. One of the most notable examples is afforded by the highway transport services of the Great North of Scotland Railway Co., which established its first highway transport service in 1903 and its first motor truck service in

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[*] Address delivered at the annual meeting of the National Highway Traffic Association.

[†] Professor of Highway Engineering, University of Michigan.

1904. In 1921 this railway company was operating five passenger routes varying in length from 7.5 to 19.5 mi. and seven intercity motor truck routes varying from 9.5 to 19.5 mi.

Railroads which have stations in scenic areas may well give consideration to another branch of the Great North of Scotland Railway Co.'s highway transport service, namely the operation of a motor bus line for tourist traffic from Aberdeen through the lake region of northern Scotland.

The short line railroads, in many cases, are faced with the alternative of suspending steam railroad passenger or freight service or both due to the high cost of operation and maintenance and the low revenues received, or of remodeling their transportation systms.

Several methods have been suggested in order that the returns on the investment may be materially increased.

The gasoline motor rail car appears to have passed the experimental stage. The utilization of this vehicle on short line railways for the transportation of passengers, express packages and l.c.l. freight is a logical economic evolution of railroad transportation methods. The development of feeder service as way stations and extensions of motor rail car service at terminals by the utilization of motor truck and motor bus lines appears logical under favorable operating conditions.

Some short-line railroads may consider it advisable to replace the track with a pavement and operate their private right of way for the use of their own trucks and buses or as a toll road or a combination thereof.

In connection with some branches of highway transport, the railroad has certain economic advantages from the standpoint of overhead expenses. A traffic department is a part of its organization and may be readily expanded to supervise its highway transport activities. The basic principles of management in an efficient railroad traffic department do not have to be developed and the economic fundamentals of the relation between operating expenses and revenues do not have to be acquired at the expansion of either business failures or costly experience. The establishment of highway transport clearing houses and warehouses will usually mean not more than a rearrangement of its shipping and receiving platforms and buildings with an expansion of such facilities as the growth of its highway transport division demands. Garages and repair shops may be combined with locomotive and car sheds. Generally idle real estate is available for administrative offices, storage tanks and other structures as they are needed.

The future development of the utilization of highway transport by railroads should receive careful consideration from the standpoint of the efficient development of transportation by railway and highway. Railways may seek powers to operate highway transport both in connection with rail transportation and independent thereof. The present Railways Bill, now before the British Parliament, said to be supported by the Northwestern and Midland Railway group, contemplates an extensive development of the utilization of highway transport by railroads throughout the British Empire with the object of securing powers to conduct highway transport of commodities carried or to be carried by railroads or independent thereof. The public should bear in mind that some railroads may have ulterior motives in seeking to secure the right to operate highway transport. An unfortunate retardation of the development of efficient highway transport in a given community might be accomplished by a railroad elimination of competition either through the control of routes by franchises or through cut throat haulage prices. If franchises are to be granted railroads for the development of highway transport services, such franchises must be safeguarded by regulations covering the service to be rendered.

The probable rapid development of the utilization of highway transport by steam and electric railroads and the fact that two-thirds of the state legislatures will be in session in the spring of 1923 leads to the conclusion that this association should have an active national committee, composed of steam and electric railway officials, highway transport operators, motor vehicle manufacturers, economists and engineers whose duty should be to formulate conclusions relative to the opportunities and rights of steam and electric railroads to function as operators of highway transport.

HARD-SURFACE ROADS SHOULD BE AT LEAST 18 FT. WIDE

A minimum width of 18 ft. for hard surface roads is recommended by the U. S. Bureau of Public Roads. The maximum width of truck body generally permitted is 8 ft., and 5.5 ft. is the ordinary clearance width of automobiles. At an average speed of 30 mi. an hour it is unreasonable to expect the driver of an automobile to drive with the wheels closer than 1.5 ft. to the edge of the pavement, says the bureau. For trucks at an average speed of 15 mi. an hour, this distance should not be less than 1.75 ft. on account of the great width of the rear wheel. Three feet seems to be a minimum safe clearance between bodies. Inasmuch as a certain amount of truck traffic is to be expected on all main country roads the minimum width of surface should be 18 ft. to provide these clearances when an automobile meets a truck.

Where the frequency with which trucks pass each other becomes a big factor, as in the neighborhood of large cities, the minimum width of pavement should be 20 ft. to provide a clearance of 3.5 ft. and a safe distance of wheels from edge of pavement.

Essex County, Michigan, will spend more than $500,000 on improved roads this year, according to a recent decision of the county council. The money will be raised by long-term bonds.

Equipment—Trade—Materials

MACHINE FOR DRILLING PAVEMENT ADAPTED TO TAKE TEST BORINGS

The machine which the Indiana State Highway Commission bought to drill cores out of the hard surface pavements to determine whether the contractors had laid the pavement according to specifications has been adapted to make test borings for bridge foundations.

The machine was purchased some months ago at a cost of $1,200. The first test was made on a section of the Lincoln Highway in Lake county and 1,200 ft. of pavement was found to be inferior and not up to the specifications. The contractor decided to give this piece of road to the state rather than tear it up and build it over again and approximately $6,000 was deducted from his contract price in the final settlement.

TEST BORING FOR BRIDGE FOUNDATION

Later, the commission bought additional equipment costing $250 which enables the driller to be used for bridge foundation exploration. It cuts a core 4 in. in diameter from the solid rock and, after this core has been tested in the commission's laboratory, the engineers know exactly what they will find below the earth's surface at the bridge site and are able to adapt their plans and design accordingly.

MIXING CEMENT WITH SOIL NEW IDEA IN ROAD BUILDING

Mixing cement with certain types of soil to alter the characteristics of the soils and make them more suitable for road surfacing and subgrades is an experiment recently conducted by the U. S. Bureau of Public Roads, which is now proving its value in actual use. The treatment was first suggested and tried out at the Arlington experimental station of the bureau. Results warranted a field test, and it was arranged with the California State Highway Department to try it on the adobe soil there.

A part of a federal-aid project in Solano county was selected for the test. The dry soil was well broken up and harrowed to a depth varying from 6 to 12 in. and mixed with cement in the proportions of 1 part cement to 10 parts soil and 1 part cement to 20 parts soil. It was intended to water and roll the surface, but rain prevented. One section was allowed to remain untreated for purposes of comparison.

A recent inspection showed that the untreated section was badly broken up, due to the usual shrinkage cracks characteristic of adobe soils. The treated sections were in good condition and showed no shrinkage cracks. The treatment is not intended to make a hard surface like concrete, but to alter the properties of the soil so that it will be stable and lessen the effects of moisture.

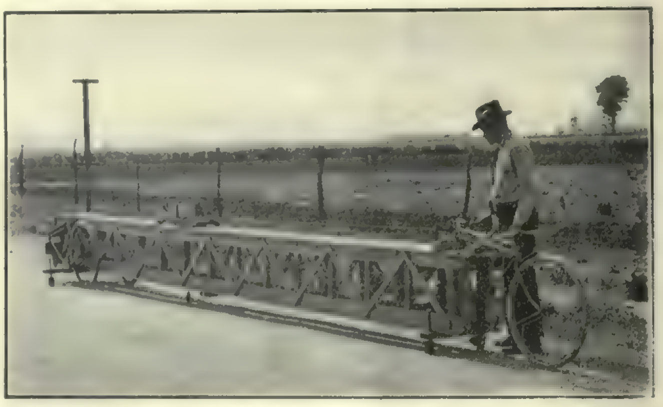
California plans to conduct additional experiments, which will be observed in detail by the bureau and cost data obtained.

OVERHEAD CAN'T BE ELIMINATED

There's a lot of wisdom in the following paragraph from the little house organ of the Juniata Company, Philadelphia: "A certain contractor was asked how he could bid so low on a very large job. He replied that this contract was so large that his overhead would be practically nothing. He lost a lot of money before he found out that it takes considerably more dough to go around a large doughnut than around a small one."

NEW DEVICE TESTS ROAD SMOOTHNESS

A traveler passing along a highway and seeing this apparatus might think it the latest development in touring machines, and sympathize with the fellow supplying the motive power. He would be entirely mistaken though for it is an apparatus devised by engineers of the U. S. Bureau of Public Roads and used on a road test in cooperation with the Illinois State Highway Department. Its purpose is to measure roughness and unevenness in a road surface before and after traffic tests, which it does with an accuracy of a small fraction of an inch.



IMPROVED METHOD OF SCREENING EFFECTS BIG SAVING IN MATERIALS

In a paper entitled "Expanding the Market for Raw Materials," delivered by H. Colin Campbell, Manager, Advertising and Publication bureau, Portland Cement Association, Chicago, before the National Industrial Advertising Conference in Milwaukee, on June 13, in connection with the convention of the Associated Advertising Clubs of the World, he emphasized the importance of the research work being carried on by the Portland Cement Association, citing as an instance the studies on the effect of size and grading of aggregates and the application of the results of these investigations to a piece of concrete highway construction in the Imperial Valley, Cal.

It was noted that at the quarry where aggregates were being obtained for the concrete used in this pavement, methods employed in screening the crushed stone for the concrete mixture caused a waste of 35% of the materials taken from the quarry. The speaker continued:

"One of our field engineers, who was interested in watching the progress of this work, and was rendering the usual cooperative service to those in charge, suggested that a change in the method of screening materials, based on our laboratory tests, would considerably reduce this waste of materials. His suggestion was adopted, with the result that a waste of only 15% followed changed methods in screening.

"What this meant to this particular job, or rather, to the taxpayers of the community who are bearing the cost of the work, was that instead of costing $1 a ton to prepare, the stone cost 42 ct., or expressed in dollars, $30,000 was saved, which made it possible for the community to build an extra mile of concrete road."

NEW STREETS FOR PHILADELPHIA

Tentative plans for an extensive street widening program, to cost $100,000,000 and to be completed by the opening of the Sesqui-Centennial Exposition in 1926, are under consideration by the Philadelphia Bureau of Surveys.

This includes the $24,000,000 necessary for widening streets under the Delaware River Bridge Commission's estimate of increased traffic arteries.

The plans drawn by John A. Vogelson, Chief of the Bureau of Surveys, call for widening 7th St. from Vine to South, and the opening of a new 120-ft. street running northeast diagonally from 6th and Spring Garden Sts. to Girard Ave. It is estimated by Mr. Vogelson that properties assessed at $12,000,000 will have to be taken to complete the improvements.

A plan is under way in Virginia to improve a part of the road through Dismal Swamp with money loaned to the state by banks and private individuals interested in the improvement, the interest to be paid by the city of Portsmouth.

CAREFUL CROSSING CAMPAIGN BEGUN

Under the auspices of the American Railway Association, there was inaugurated on June 1 and continued to September 30, 1922, a careful crossing campaign having for its purpose the prevention of or reduction in the number of highway crossing accidents involving railroad trains, vehicles and pedestrians throughout the country. Cooperation in the plan has been assured by the National Automobile Chamber of Commerce, the National Highway Traffic Association, National Safety Council and numerous other organizations. The slogan for the campaign is, "Cross Crossings Carefully."

That such a campaign is necessary is shown by the following facts. In 30 years, our country's population has increased 68%. In the same period, crossing accidents have increased 345% in fatal and 652% in injury cases. In 1920, automobiles were involved in 76% of all crossing accidents. During that year, 1,791 persons were killed (death resulting within 24 hours) and 5,077 were injured. Of the latter number, 116 died subsequently as a result of injuries sustained in the crossing accident.

The most obvious way to stop these accidents would be to eliminate the crossings but that is impossible. According to the figures of the American Railway Association, there are in the United States 251,939 highway crossings on Class 1 railroads alone (revenue of over $1,000,000 annually). Of this number, 399 were eliminated during 1919. At that rate of elimination, it would take 629 years to dispose of all the crossings provided no more were added. It is further estimated that, taking a conservative figure of $50,000 per crossing, the complete elimination would cost $12,500,000.-000.

The railroads have learned the value of education from the success of their "Safety First" campaign among their employees which reduced the deaths from accidents of men on duty from 4,354 in 1907 to 2,578 in 1920. Therefore, they feel that an educational campaign is the immediate solution of the problem of doing away with accidents at highway crossings. The association appeals to all right thinking people for their support in this campaign.

The Hercules Powder Co., of Wilmington, Del., has just issued in attractive pamphlet form a paper entitled, "Dynamite—the New Aladdin's Lamp," written by the vice-president of the company, Mr. T. W. Bacchus, and read before a recent meeting of the Hercules Club. It is an interesting and accurate account of the part played by dynamite in the industrial development of this country.

The Pennsylvania State Highway Department annually suspends all oiling operations on the state highways from June 30 to July 5 to permit uninterrupted traffic over the holiday.

MEETINGS

Calendar of Coming Meetings

August 4-5, Texas Highway Association—General convention at Galveston, Texas. Secretary-treasurer, Room 1910, F. & M. Bank Bldg., Fort Worth, Texas.

Aug. 9-10—Custer Battlefield Highway Association—Annual meeting, Sheridan, Wyo. Secretary, W. D. Fisher, Sheridan, Wyo.

Oct. 2-6—American Society for Municipal Improvements—Annual convention, Cleveland, O. Secretary, Charles Carroll Brown, St. Petersburg, Fla.

S. P. E. E. FAVORS BROADENING OF ENGINEERING EDUCATION

Papers presented at the annual meeting of the Society for the Promotion of Engineering Education held at Urbana, Ill., June 20-23, dealt with the subject of making more broad and cultural the course in engineering schools. Resolutions were adopted by the council of the body which directed the president to appoint a committee to study the question and discover what the society can do to "develop, broaden, and enrich engineering education." No action was taken on the matter of five year engineering courses proposed by the deans of the mid-west technical schools.

The election of officers resulted in the re-election of Prof. Charles F. Scott of Yale University as president, and the election of new officers as follows; vice-presidents, D. C. Kimball of Cornell and F. G. Higbie of Iowa; members of the council, M. W. Alexander, National Industrial Conference Board, Edward Bennett of Wisconsin, H. S. Evans of Colorado, E. A. Hitchcock of Ohio, H. J. Hughes of Harvard, C. E. Magnussen of Washington, and G. C. Shaad of Kansas State.

It was decided to hold the convention next year at Ithaca, N. Y.

AMERICAN SOCIETY OF CIVIL ENGINEERS CONVENES AT PORTSMOUTH

All the business of the annual convention of the American Society of Civil Engineers held in Porthmouth, N. H., June 21 and 22, was transacted by the board of directors at a meeting held two days prior to the convention. At that meeting, John H. Dunlap, Professor of Hydraulics and Sanitary Engineering, State University of Iowa, Iowa City, Ia., was elected secretary, was notified of his election, and wired his acceptance. Professor Dunlap is now president of the Iowa Enginering Society and of the Iowa section, American Society of Civil Engineers held in Portsther discussed the question of joining the Federated American Engineering Societies but postponed action until a later meeting. A change in the by-laws was made to permit the formation of technical divisions on the application of 20 members, the section then being authorized to include non-members in its activities. Four such divisions were authorized at the meeting; highway, power, irrigation, and sanitary engineering. Four prominent engineers, one from this country and three from abroad, were elected to honorary membership in the society by action of the board of directors.

The business meeting of the convention lasted only long enough to announce the results of the actions of the board of directors. As the weather was rainy, several trips planned for the delegates had to be abandoned and most of the time was given over to listening to technical papers. Among the speakers was Prof. W. K. Hatt, Director of Highway Research, Engineering Division, National Research Council, who made a report on the various tests on highways now going on in the United States.

C-B-H ASSOCIATION TO HOLD CONVENTION

The Custer Battlefield Highway Association will hold its third annual convention at Sheridan, Wyo., Aug. 9-10. An interesting two-day program has been arranged and Sheridan is planning a royal entertainment for her visitors. The governors of Wyoming and South Dakota will address the convention as will representatives of the state highway departments of Montana, Wyoming and South Dakota and various officers of the association.

PERSONAL MENTION

John H. Dunlap, Professor of Hydraulic and Sanitary Engineering, State University of Iowa, was elected secretary of the American Society of Civil Engineers at the annual meeting at Portsmouth June 21-22. He succeeds Elbert M. Chandler who has been acting secretary. Prof. Dunlap was born at Harrisville, N. H., Sept. 9, 1882. He was graduated from Dartmouth College in the class of 1905 and received his C. E. degree from the graduate school of engineering three years later. After graduation, he joined the faculty of the State University of Iowa as instructor and has ben promoted to the position he now holds. In addition to his university work, Prof. Dunlap has devoted part of his time since 1915 to private practice as a civil and sanitary engineer.

W. C. Earle has been appointed city engineer of Pasadena, Cal.

Harry W. Phillips has been appointed superintendent of construction for the city of Davenport, La.

12a

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Vol. LXIII July 12, 1922 Number 2

TABLE OF CONTENTS

Regulate Trucks or Destroy Highways—Which? . . 13

Bond Issue Campaign Under Way in Colorado . . 14

Maximum Weights, Speeds and Widths of Motor Trucks 15

Fourth Bulletin on Bates Road Tests 19

EDITORIALS:

Motor Truck Regulation 17

To Prevent Overloading of Trucks 17

Plans for Forest Highway Approved 18

Good Roads Association of New Jersey Organized . 18

MEETINGS:

Calendar 20

The A. A. A. Takes Action 20

Road Building Problems Are Discussed at Conference 20

PERSONAL MENTION 20

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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Regulate Trucks or Destroy Highways[*]–Which?

By J. N. MACKALL[†]

It was the boast of one of the largest manufacturers of motor trucks a year ago that whenever a highway engineer brought out a new type of road his company brought out a type of truck heavy enough to destroy it. The competition between the road builder and the truck builder was an exact parallel to the competition which has gone on for ages between the safemaker and the burglar. Let us hope that always in road building, as in safemaking, the safemaker will be just a little ahead of the burglar.

Many more miles of usable highways are being destroyed every year by motor trucks carrying greater loads than those which the roads will stand than are being replaced in the same time, so that actually little or no progress has been made in most of the states in road building. Many states have records of roads constructed and destroyed before the first bonds for their construction had matured, and one eastern state, at least, with which the writer is familiar, has roads which have been built three times from bond issues before the first bonds were paid off.

The motor truck manufacturer excused himself, as did the motor truck operator, by simply saying that the roads were not properly built, never for one moment admitting that the loads which went over them were perhaps greater than those which the roads would stand. The propaganda department of one of the large producers of a commodity entering into high grade road construction started the slogan a few years ago, "Build the road to carry the load." This slogan was extensively taken up and carried forward because it sounded so plausible. The writer took exception to it, and asked instead that a slogan be adopted, "Limit the road to one which the road will carry." Of course, this slogan did not get far, because it did not sound plausible, yet an analysis of the facts will show that it is absolutely essential.

The State of Maryland in 1918 paid dearly for the lesson which it later learned, but perhaps not too dearly. At that time trucks were permitted under the law with a maximum load of 28,000 lb., and actually were permitted to carry any load they desired because no maximum limit was enforced. Consequently many loads of this capacity were carried and many larger. The main road in the state from Philadelphia to Baltimore to Washington was completely destroyed at many points and rendered practically valueless for its entire length because of the infinite number of breaks which came in it. Fortunately, the legislature was in session at that time, and the public could be made to realize the great necessity for some effective regulation of motor truck traffic.

When it was proposed to limit the load to 20,000 lb. under any consideration, the manufacturers and users immediately set up a howl that the industrial expansion of the country was being curtailed.

A study was made of the traffic which went over this road for a year preceding and during the time of the failure, and it was determined that if the loads carried on units of 5 tons or larger had been carried on units of 3 tons, and allowing the manufacturers' rated efficiency of the 5-ton unit over the 3-ton unit, the extra cost to the operators would have been $15,000. The cost of repairing this road was $600,000. Obviously, the state could no longer continue to spend $600,000, in order that a few persons might save $15,000.

The legislature of 1918 enacted a law with three outstanding features in it:

(1) That no vehicle, of which the weight of vehicle and load combined exceeded 20,000 lb., should be operated over the public highway at any time or under any condition.

(2) That the load coming on the road should not exceed 650 lb. per in. width of tire.

(3) That no vehicle should carry a load greater than that for which application had been made and fee paid.

The state highway department then felt that it was its duty to see that the law was enforced, and that whether it was practical or impractical of operation depended puon a strict enforcement of it, so that subsequent legislatures could make whatever changes were desirable. It is interesting to note here, parenthetically, that there has been no demand whatever on the part of the public operating trucks, or of the dealers selling trucks in Maryland to increase these weights.

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[*] Paper read at a regional conference for the study of highway engineering and highway transport held at The Agricultural and Mechanical College of Texas, February 6 and 7, 1922.

[†] Chairman and Chief Engineer, States Roads Commission, Baltimore, Md.

It has been clearly demonstrated previously that these heavy trucks could not be legislated off the road by high license fees. If it was desirable to get rid of them, then it must be done by positive and definite legislation, and enforcement of this legislation. The highway department equipped with a crew with portable scales which could be used to weigh trucks at any point, and on two main roads leading out of Baltimore, with permanent scales on which all motor trucks were weighed.

The men in charge of weighing of the trucks were always accompanied by a uniformed officer from the commissioner of motor vehicles, and all arrests and prosecutions were actually made by a uniformed officer. Every man whose vehicle was found to violate any of the outstanding features of the law was prosecuted, but this did not serve to break up the practice of overloading. In many instances, it was more economical and satisfactory to the operator of the truck to pay a fine, if overloaded, than to discontinue the practice, so that in addition to prosecutions, the officers insisted upon the removal of all excess loads at the point where the arrest was made.

There was perhaps no positive authority to remove the overload. Neither is there positive authority for confiscating stolen property in the hands of the thief, but if the legislature prohibited the carrying of a load in excess of 20,000 lbs. when a vehicle was detected with a greater load than this, it was obviously within the province of the state to remove the load greater than 20,000 lb. In any event, no offender has ever seriously objected to or tested the right of the state to cause the removal of the overload. This effectively and quickly broke up the practice of overloading, so that now the State of Maryalnd finds this traffic less than .01 per cent overloaded. The fine for overloading would perhaps run $10, $25 and in some cases $100, but this was very small in comparison with the cost of procuring another truck to come back and pick up the overload which had been taken off on the road, especially if the overload happened to be perishable commodities. The patrolman has compelled the removal of fresh beef from overloaded trucks in the month of July. However, it was not necessary to remove this but once.

The actual enforcing of the motor vehicle law has, been responsible for the elimination of road failures in the State of Maryland. Since 1918 no road in the state has been permitted to fail. True, wear and tear have occurred, but actually no single instance of a road breaking up has occurred since the overloaded truck was put off the highway. Eternal vigilance may be the price of liberty, at least, it has been accepted as a fact for many years, but the public must be brought to a realization that eternal vigilance is the price it must pay for good roads. Financially, this country cannot stand long to build roads for the abuse of the user, but it can afford to build them for the use of the public, and we may go further and say that it cannot afford not to build them for the use of the public, but there is a difference between use and abuse. The difference is perhaps small in some cases, great in others, but it exists, and it is the right of every community to see that the roads which it has built are used and that they are not abused. If use without abuse in certain localities means the limiting of the gross load to 5 or 6 tons, then this must be done. It is certainly much more satisfactory from every point of view to limit the gross load down to 6 tons and carry it, than to let it go to 10-12-14 tons, and destroy the roads, so that they will not be of service to the potential truck operator or to the traveling public.

Much sentiment has swayed road building, road maintenance and road use. It is a business surrounded by cold hard facts and until it is accepted as such, and our road problem treated as a business and not a sentimental proposition, will we have made any steps toward solving it, and those who are responsible for the building and maintaining of the nation's highways must ascertain for themselves what is best to be done, and do it, and not be swayed by the truck manufacturer or the truck user, who desire to have roads built far beyond the ability of their neighbors to pay, in order that they may carry these very heavy loads when, where and how they please, with no regard for the economics of the situation.

BOND ISSUE CAMPAIGN UNDER WAY IN COLORADO

Civic and commercial organizations and highway boosters throughout the state of Colorado at a meeting early in June launched a campaign for a $6,000,000 highway bond issue to meet federal aid appropriations for the next four years. By the terms of the proposed bill, the state highway department's half of the revenue derived from automobile licenses is to be used to pay the interest and to provide a sinking fund for the retirement of the bonds. Advocates of the bill declare that in this way the money can be raised without putting any additional tax burden upon the people. Petitions have been prepared and are being circulated by members of the Denver Civic and Commercial Club, the Lions Club, the Rotary Club, the Kiwanis Club, the Optimists Club, the Gyro Club, the Motor Club, and other organizations. The money, if voted, will be used to match federal aid funds dollar for dollar and will insure $12,000,000 to be spent during the next four years. It will be used at the rate of $1,500,000 a year.

Maximum Weights, Speeds and Widths of Motor Trucks*

By C. W. Cornell†

To construct highways which will meet the requirements of the future and keep within reasonable bounds in the matter of cost, careful consideration should be given to the loads which these highways will be called upon to support. The structural engineer cannot design a warehouse floor, unless he knows the maximum load, per sq. ft. which is to be carried, and so the highway engineer and road builder must be given some definite data, regarding the gross weight of the heaviest vehicle which will be allowed on the highway.

Considerable attention has been given in the United States during the past two or three years to the study of the impact or blow delivered to the road by moving vehicles. The most notable of these studies are those carried on by the Bureau of Public Roads at Washington, D. C., and the quasi public experiments carried out by the Columbia Steel Company at Pittsburg, California. The Washington experiments are still under way but several progress reports have been made. The Pittsburg work has been completed but the engineer's report is not as yet available.

Without going into details as to the results of these experiments, it might be stated, that the following facts have been reasonably well established:

1. Impact may be as high as 7 times the static load on one rear wheel, when a solid tired truck strikes a 1-in. obstruction at 16 mi. per hour, an average value being about 4 times.

2. For pneumatic tires, the maximum impact value is probably not more than 1¾ times the load on the rear wheel, and an average value is not more than 1¼ times the load.

3. The impact developed by a vehicle, with either solid or pneumatic tires, on a smooth road, is less when running, than when standing still; however, if the road becomes rough, impact increasts rapidly.

4. Spring suspension, unsprung load, shock absorbers, cushion tires, load distribution, etc., all have an effect upon the impact.

5. In general, it may be said that a heavy vehicle, having a heavy unsprung load, and badly worn tires, operating on a smooth road produces a relatively small impact, and consequently does comparatively little damage, while the same vehicle operating on a rough or uneven road creates impact proportional, in some degree, to the roughness.

The conclusion, therefore, is, that if we construct our highways with smooth surfaces and maintain them in the same condition, we need only have consideration for static loads, but if the road surface is rough, either because of poor construction or improper maintenance, we must study the effect of impact and provide means of overcoming its effect. Theoretically, a perfectly smooth highway which will bear the standing or static load without failures will continue to do so indefinitely. However, our theory is spoiled in practice, because of wear due to abrasion, the action of the elements, the settling of the sub-base and last but not least, the movements of the slab or surfacing, due to temperature changes.

To determine the maximum allowable loads which may be carried on our highways, we should reduce all of our data to the load per sq. in.

Determinations have been made of the crushing strength of well made concrete road slabs, and values varying between 2,400 and 3.,300 lb. per sq. in. have been obtained. Assuming 2,500 lb. to represent the crushing strength, and bearing in mind that impacts may run as high as 7 times the static load, we divide 2,500 lb. by 7 and obtain 357 lb. which presents the total allowable static load per sq. in.

Table 1 represents the results of investigations carried on by a well known tire manufacturer, relative to the respective contact areas of various sizes of new solid truck tires, when loaded to capacity.

It is to be noted that while these contact areas and loads per sq. in. give us a general idea of conditions surrounding this very important subject, they are subject to considerable change, when we consider other makes of tires, tires with high or low profiles, tires capable of deformation under moderate loads and tires which have been so worn out as to reduce their flexibility to a minimum. In general it is reasonable to make the following assumptions regarding tires which have been worn to some degree, but not to the point of losing all of their deformation qualities.

1. The width of contact of the tire with the pavement is 75% of the width of the base between flanges.

2. The peripheral contact varies from 5.8 in. to 8.6 in. for new tires and will probably have a conservative value of 4 in. for worn tires.

Assuming that the working load on a concrete pavement should not exceed 357 lb. per sq. in., we make the following calculation:

Working load 357 lb. x 4 in. of peripheral contact = 1,428 lb. per in. width of contact, and 1,428 lb. per in. width of contact x .75 = 1,070 lb.

It would, therefore, appear that a loading of 1,070 lb. per in. width of tire, measured between the flanges of the base, would represent even under adverse conditions, where the impact becomes as much as 7 times the static load, a load that is not excessive. Recognizing, however, that tires frequently become badly worn, and that overloading is still somewhat prevalent, our National Automobile Chamber of Commerce, has recommended a loading of not to exceed 800 lb. per in. width of tires, base measurement.

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*Paper presented at the convention of the Canadian Good Roads Association, Victoria, B. C., June 12-15, 1922.

†Manager, The White Company, Seattle, Wash.

A study of trucks of various makes and capacities, develop the fact, that the usual or average distribution of the gross load, between the front and rear axles, is 20% and 80% respectively. The maximum size of tire in use on rear wheels is 14 in.; therefore, the total allowable load on the rear axle is 2 x 14 x 800 = 22,400 lb., and the gross load on 4 wheels

$$\frac{22{,}400 \times 100}{80} = 28{,}000 \text{ lb.}$$

which is the maximum allowable gross load recommended by the N. A. C. C.

creased. The net result clearly shows a loss to the owner. In addition to these very good reasons for restraining overloading, we are daily becoming more impressed with the fact, that overloading is playing a very important part in highway construction.

To simply restrict the gross load to 28,000 lb. with the further proviso, that 800 lb. in. width of tire be not exceeded, is not sufficient. These restrictions do not in fact, effect any but the heavy duty trucks. A small truck, say a 1½ ton equipped with 5 in. rear tires may carry 8,000 lb. on the rear axle or 10,000 lb. total gross weight. The average 1½ ton chasses and body, weighs 5,400 lb. which leaves a pay load of 4,600 lb., or an overload of 1,600 lb. or 53%. As a matter of fact, the smaller size tires should not be loaded in excess of 500 lb. per in. width, because of the fact that the depth of rubber is much less than in the larger sizes.

Tire Size	Capacity Load lb.	Load per in Width lb.	Width of Tread in Contact in.	Percentage of width in contact to base	Peripheral contact in	Peripheral contact per 100. lb. load in.	Area contact sq. in.	Load per sq. in.
36x 3½	1,300	372	2.28	65.0	5.79	.445	13.2	99
36x 4	1,700	425	2.50	65.5	5.71	.336	14.3	119
36x 5	2,500	500	3.25	65.0	6.89	.276	22.4	112
36x 6	3,300	550	3.94	65.6	6.96	.205	27.4	120
36x 7	4,200	600	5.31	75.9	7.16	.170	38.0	111
36x 8	5,200	650	6.25	77.8	7.61	.146	47.6	107
40x10	7,000	700	8.06	80.6	7.85	.112	63.3	111
36x12	9,500	792	9.50	79.1	8.40	.089	79.9	119
40x14	11,500	822	11.50	82.1	8.61	.075	99.1	116

It will be noted that the foregoing recommendations with reference to gross weight, and weight per in. width of tire, apply only to trucks equipped with solid tires. Investigations have demonstrated that the pneumatic tired truck or bus, does little if any damage, and inasmuch as the gross load which may be carried on pneumatic is closely limited by the carrying capacity of the tires themselves, it is not considered necessary to limit the weight on this type of tire equipment.

Speed is evidenly a factor in impact, but to what exact extent has not been determined. We can only say that trucks equipped with solid tires, operating at speeds greater than 20 mi. per hour, will in all probability do considerable damage to the highway, if not to the trucks themselves, and if they be of the heavy duty type will be a menace to safety.

The following schedule is offered, as being sufficiently restrictive to protect the highway, and still allow the operator the right to use his vehicle to the best advantage.

Gross weight not over 15,000 lb.—not over 20 mi. per hour.

Gross weight over 15,000 lb. but not over 24,000 lb. —not over 15 mi. per hour.

Gross weight over 24,000 lb. but not over 28,000 lb. —not over 10 mi. per hour.

Nearly all reputable manufacturers of trucks are attempting to educate truck operators as to the folly of overloading. They demonstrate that the life of the truck is reduced, and its daily cost of operation in-

We, therefore, see that to obtain complete protection for the highways, we must prevent overloading. It is my opinion that this can be accomplished best, by requiring each manufacturer of trucks, to file with the proper state a schedule showing the various models which he manufactures, together with the rated capacity of each, and the standard tire equipment. Owners should then be required to register their trucks, and pay license fees according to capacities.

This system will not only prevent the overloading of trucks with attendant dangers to public safety, but will prevent overloading of tires beyond their rated capacities, and thus protect the highway. This system will also insure the owner paying a license fee in proportion to his capacity of truck.

To facilitate the enforcement of the law, it would be well to require that all trucks have painted, on each side in block letters, not less than 12 in. high, the capacity in tons, and also in small letters the actual weight of the truck unladen.

In conclusion I should like to leave with you several thoughts, which I believe will be of assistance to you, in the promotion of good roads, and in making use of these roads to the best advantage possible.

1. Some exact limit, say 28,000 lb. should be fixed as the maximum allowable gross load on four wheels. It would be preferable to have this limit uniform throughout the country, and it would not seem ad-

(Concluded on Page 18)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. L. POWERS
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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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MOTOR TRUCK REGULATION

One of the most important subjects vitally affecting the future development of motor transportaion and highway construction is the question of limiting the size, weight and speed of motor trucks. On this subject, there is a wide difference of opinion between the engineers who design the roads and the officials who finance them on the one hand and the motor truck operators and manufacturers on the other. The two articles in this issue, one by John N. Mackall of the Maryland State Roads Commission and the other by W. C. Cornell of The White Company, represent this difference of opinion.

The limitation to be placed on trucks using the highways of the country, as suggested by Mr. Cornell, are the limitations advocated for uniform adoption by the motor interests. New York state passed a law last year which set that limit of 28,000 lb. gross weight of vehicle and load.

On the other hand, we find Wisconsin setting the limit for class "A" roads at 24,000 lb. and for class "B" roads at 15,000. In Massachusetts, James W. Synan, of the State Highway Commission, is authority for the statement that they are seriously considering a limit of 20,000 lb., including truck and load, as a means of preserving their roads. A communication from W. A. McLean, Deputy Minister, Department of Public Highways, Ontario, Canada, states that the present law there permits a maximum weight of vehicle and load of 24,000 lb. and at the present legislature a law has been enacted which would permit the government to reduce the maximum load to 20,000 lb. So, it will be seen that the State of Maryland is not alone in setting the limit below that advocated by the manufacturers and operators of motor trucks.

Another feature of the regulations prohibits overloading; that is, putting 5 tons on a 3-ton truck, loading the truck above its rated capacity. With that provision, the truck manufacturers agree. They say that a truck will not give service if loaded with a greater load than that for which it was designed and that a customer who overloads his truck is apt to be a dissatisfied customer. That is just the point that Mr. Mackall makes in regard to roads. He is a designer of roads and does not want to see the highways subjected to a greater load than they are capable of carrying any more than the designer of a 3-ton truck wants to see is forced to carry 5 tons. When the motor interests say that they are opposed to overloading their trucks, the highway engineer agrees and then asks if the same principle does not apply to his roads. The proposition, then, would seem to be to fix limits for various classes of roads as has been done in Wisconsin.

TO PREVENT OVERLOADING OF TRUCKS

State Highway Commissioner Herbert S. Sisson of New York has started a campaign to prevent the overloading of motor trucks on the highways of the state and has secured the cooperation of the state police in enforcing the law passed by the last legislature. The troopers assigned to the work have been provided with loadameters and motor vehicles to facilitate inspections and to detect violations. The law sets the load limit at 28,000 lb. and makes violators liable to fine and imprisonment. It also provides that the overload may be taken off the truck and left by the roadside. The commissioner is determined to enforce this law. The nine division engineers have been notified that the state troopers will continuously carry on their investigations on the trunk routes and the county superintendents of highways have been requested to keep them informed of traffic conditions.

A recent election in Hillsborough County, Florida, to authorize a $3,000,000 bond issue for road improvement was declared illegal three days after the vote was cast on the ground that the notice of the election had not been published as required by law. The county is faced with the alternative of calling a new election or asking the next legislature to validate the election already held.

The chief of the U. S. Bureau of Public Roads will probably never personally inspect all of the system of federal-aid roads provided for by the Federal Highway Act and for which initial appropriations have been made. Should he make an inspection, traveling at the rate of 30 mi. an hour, 8 hours a day on all working days, and not go over any mile twice, it would require nearly 2½ years to complete the job.

(Concluded from page 16)

visable to lower the limit. as it should remain in force for a number of years.

2 The maximum allowable load on solid tires be not more than 800 lb. per in. width, base measurement.

3. Speeds on solid tires be not greater than 20 mi. per hour and reduced in proportion to the gross weight of the vehicle.

4. No speed or road regulations are necessary for pneumatic tires.

5. Trucks should not be loaded in excess of the manufacturer's rated capacity.

6. Highways should be constructed with smooth surfaces.

7. Well organized maintenance of highways, should be in vogue, and the keynote of this maintenance should be smooth surfaces.

PLANS FOR FOREST HIGHWAYS APPROVED

In order that the great national park system of the country may be made more largely available to the American people, an extensive program of national forest highway construction has been planned by the government and Secretary of Agriculture Wallace has approved the plans which involve the expenditure of approximately $10,000,000 for 1,170 mi. of road in 23 states.

TYPICAL SCENE ON FOREST HIGHWAY

This program will be financed largely from the forest highway fund provided for by the Federal Highway Act. About $6.500.000 will come from this source, $1,000.000 from other national forest road appropriations, and the balance of $2,500,000 will be contributed by states and counties.

The funds and mileage are for forest roads of primary importance to states, counties, and communities. The program was recommended to the Secretary by the Forest Service and the Bureau of Public Roads, jointly, after conferences with state officials. The Bureau of Public Roads will supervise the construction work, and it is expected that a large number of the projects will be completed this season.

Practically all the roads to be built are parts of the state or county highway systems and will therefore in most cases connect with and extend the system of Federal-aid highways covering the whole country. In some cases the new construction will provide roads through mountainous regions of the national forests hitherto penetrated only by pack trails.

In addition to the major road projects, about $5,000,000 will be expended by the Forest Service on minor roads and trails required primarily for the protection and administration of the national forests.

The work provided for is as follows:

State	Proposed Expenditure	Miles
Alabama	$ 3,953	15
Alaska	896,850	55
Arizona	1,011,500	133
Arkansas	142,796	23
California	1,246,197	50
Colorado	627,000	105
Florida	91,175	14
Idaho	1.269,600	137
Montana	566,421	75
Nebraska	9,958	22
Nevada	166,000	24
New Hampshire	29,288	5
New Mexico	452,000	64
Oklahoma	4,572	3
Oregon	2,270,000	210
South Carolina	2,173	5
South Dakota	61,000	7
Tennessee	15,000	3
Utah	292,100	56
Virginia	20,000	4
Washington	780,000	50
West Virginia	4,901	20
Wyoming	260,150	90
	$10,222,634	1.170

GOOD ROADS ASSOCIATION OF NEW JERSEY ORGANIZED

With the $40,000,000 highway bond issue coming up for referendum vote of the people at the November election, the Good Roads Association of New Jersey which has been in a state of formation for some time was formally organized at a meeting in Newark, June 20, for the purpose of stimulating interest in the good roads movement.

The purpose of the new association is described as being "To organize the citizens of the state of New Jersey into an association to develop the use of and construction of good roads by townships, towns, cities, boroughs, counties and states; to advance and stimulate by all legal means the education and instruction of the public in good roads; to conduct meetings and to do anything else which in any way will assist in furthering the objects for which this association is organized."

The organization has established headquarters at 828 Broad St., Newark, and will immediately begin an educational campaign for the bond bill. The expenses of the movement will be met by a membership fee of $1. Harry M. Meixell, of the Motor Vehicle Conference Committee of the National Automobile Chamber of Commerce, has been named as secretary and Claude E. Holgate, of the Newark Automobile Association, will be in charge of the publicity.

Fourth Bulletin on Bates Road Tests

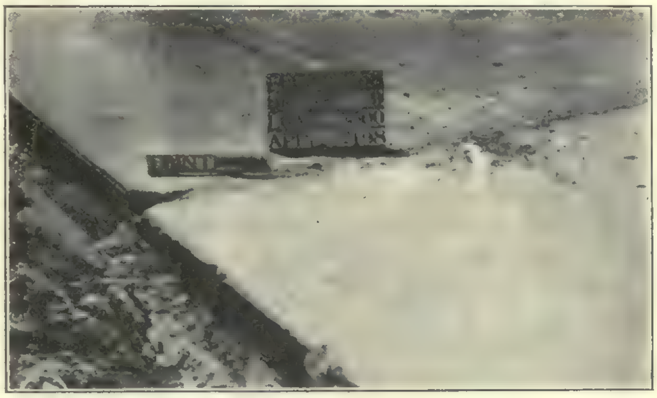
Completion of the fourth increment of the traffic runs on the Bates road was made Wednesday afternoon, June 14th, just nine days after the run was begun. As in the third run, 3,000 applications of the load were made, 2,000 being imposed in the daytime and 1,000 at night. The fourth increment consisted of a load of 5,500 lb. on each of the rear wheels of the trucks and 1,900 lb. on each of the front wheels. The same trucks were used as in the former runs. The loads as applied correspond to 550 lb. per in. of nominal width of rear tire, and 380 lb. per in. of nominal width of front tire.

A slight variation, in the time of application of the day and night runs, was made with the fourth increment. The first 1,000 applications were made in the day time, followed by 1,000 at night with the last 1,000 day applications ending the run. The track of the traffic was the same as in the third run, the trucks traveling with the outside edge of the rear wheel 2.5 ft. from the north side of the pavement and directly on the edge on the south side. The complete destruction of the first five sections under the third increment made it impossible to travel on these further, and the end of the trips was made at section 5.

The exceptional strength of section 58, 4-in. concrete on 4-in. rolled stone base, in withstanding the first three increments of load without any apparent failures was entirely unlooked for as all other 4-in. concrete sections had shown failures to some degree. It is thought that the subgrade under section 58 has been dried out to such an extent that the rolled stone base is more than usually firm. Moisture sample tests under concrete pavements that have been laid directly on the subgrade show a moisture content of soil practically as high as that obtained during the spring months when the tests were begun. Therefore, these sections are receiving the heavy loads while in the same condition as when they received the light loads at the beginning of the runs, whereas the subgrade of section 58 was in its most saturated condition only during the applications of the lighter loads. As it is evident that pavements must at all times be designed to receive maximum loads, it was decided to place section 58 on the same basis as the other sections in so far as being subjected to loading under the least resistant condition. At the end of 1,750 applications of the 5,500 lb. load a ditch was dug in the shoulder along the south edge of section 58 and filled with water. This allowed the rolled stone base and the subgrade to soak up water and approximate the condition of the pavement during the heavy rain season. To be sure that the water passed completely through the entire width of the section, holes were dug along the north edge of the section. The appearance of water in these holes within 45 min. from the time of application at the south side was sufficient proof that the experiment was successful. The stone base, with the exception of one small corner, was saturated within 12 hours. Fully 1,900 gal. of water were necessary to place the subgrade in the condition desired.

Two decisive corner failures occurred in section 58 within a short time after the subgrade was treated with water. These failures would have undoubtedly occurred at the first of the tests when the subgrade was watersoaked had this load been applied at that time.

Under the load of 5,500 lb. it was expected that failures would occur in most of the 5-in. rigid pavements as a tensile fibre stress of up to 500 lb. per sq. in. is produced in a 5-in. rigid pavement when this load is applied 6 in. from the corners, these corners being considered as unsupported cantilevers.



CORNER FAILURE IN SECTION 58

This load applied in like manner to a 6-in. rigid pavement produces a tensile fibre stress of up to 400 lb. per sq. in. or approximately 65% of the strength of the concrete as determined by representative specimens. As this stress is above what has been indicated as the critical percentage to produce fatigue in concrete, there was a possibility of failures occurring through fatigue.

Under the fourth increment of 5,500 lb., 38 decisive failures resulted, 22 occurring during the day time runs and 16 in the night runs. Attention is called to the marked difference in the number of failures which occurred along the north line of traffic as compared with the failures along the south edge of the pavement. Only four failures were present in the north side, all the remaining 34 developing on the south side where the line of traffic was directly on the edge of the pavement. These figures prove the contention that, if the line of traffic can be held away from the edge of pavements, less failures will occur than when the wheels of the trucks pass directly on the edge. As the number of night time applications was just half the number applied during the day, it is again indicated that the greater damage to pavements occurs during night traffic when the edges of the pavement are curled away from the subgrade.

The next increment of load to be applied will be such that each rear wheel of the trucks will carry 6,500 lb., and each front wheel 1,800 lb. As in the cases of the other increments, the additional load on the rear end of the trucks removes part of the load on the front wheels. The number of applications of the fifth increment will probably be 3,000, with 2,000 applications being imposed during the day and 1,000 at night.

PERSONAL MENTION

John Leonard Vogel, formerly Designing Bridge Engineer, Board of Public Utility Commissioners, State of New Jersey, has been appointed bridge engineer of the New Jersey State Highway Department, effective July 1.

Charles J. Bennett, State Highway Commissioner of Connecticut, received the honorary degree of Master of Arts from Yale University at the recent commencement.

Rufus K. Sanders, Saltville; **Hugh B. Sproul**, Staunton; **Wade H. Massie**, Sperryville; **L. Walker Truxton**, Norfolk, have been named members of the Virginia State Highway Commission created by the last legislature. Henry G. Shirley had been previously named chairman.

James I. Vincent has been appointed eastern representative of the Chicago Bascule Bridge Company with offices at 30 Church St., New York City. Until recently, Mr. Vincent was in charge of the New York office of the Strauss Bascule Bridge Company.

John Laylin, formerly with the Ohio State Highway Department, has been appointed superintendent of public works of Columbus, Ohio, to succeed E. S. Smith, resigned.

Creighton D. Bickley has been appointed highway construction engineer of Essex County, New Jersey.

Jacob Labisniner has been appointed city engineer of Amsterdam, N. Y.

Robert E. Kelley of Willimantic, Conn., has been appointed an engineer of bridge construction for the Maine State Highway Department.

W. H. Steiner has been appointed district engineer in charge of the Des Moines office of the Portland Cement Association to succeed H. L. Tillson, resigned. Mr. Steiner has been connected with the Portland Cement Association for the past three years, spending all that time in Iowa. Previous to joining the association, he was city engineer of Marshalltown, Ia., for ten years.

W. W. Harmon has been appointed city engineer of Oakland, Cal.

MEETINGS

Calendar of Coming Meetings

August 4-5, Texas Highway Association—General convention at Galveston, Texas. Secretary-treasurer, Room 1910, F. & M. Bank Bldg., Fort Worth, Texas.

Aug. 9-10—Custer Battlefield Highway Association—Annual meeting, Sheridan, Wyo. Secretary, W. D. Fisher, Sheridan, Wyo.

Oct. 2-6—American Society for Municipal Improvements—Annual convention, Cleveland, O. Secretary, Charles Carroll Brown, St. Petersburg, Fla.

THE A. A. A. TAKES ACTION

Official notice of the defection of some of its members at the St. Louis Convention and the formation of the National Automobile Association was taken by the executive board of the American Automobile Association at a recent meeting in New York. The first action was to rule that the Ohio State Association, under recent developments, is not functioning properly and to admit the Cincinnati Automobile Club to direct membership. The second was to expel the Illinois State Association. The Cincinnati Club with the Youngstown Club which has remained loyal will form a nucleus for a new state organization in Ohio. Similar steps will be taken in Illinois. Bulletins from national headquarters state that the A. A. A. will soon have an organization in every state and will be even stronger than before the trouble in the convention and the formation of a rival association.

ROAD-BUILDING PROBLEMS ARE DISCUSSED AT CONFERENCE

The committee on tests of the American Society of State Highway Officials met with the officials of the Bureau of Public Roads in Washington, June 26 and 27, to consider standardization of specifications and tests for road materials. The purpose of this meeting of representatives from all sections of the country was not so much to lay down rigid rules as to harmonize the general practice. Standardization taking into account local conditions is being brought about by a series of meetings between officials from groups of states and engineers of the bureau. The present activity of highway officials along this line is most encouraging for road building. A few years ago the general tendency was toward individuality in each state, without much opportunity for exchange of ideas and knowledge. Today the tendency is in the other direction, and a better solution should be reached when the problems are discussed at meetings of the best highway engineering talent of the country.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Vol. LXIII July 19, 1922 Number 3

TABLE OF CONTENTS

New Concrete Bridge in Southwest 21

Recent Progress in Highway Research By Dr. W. K. Hatt 22

Illinois Division of Highways Reports on Bates Road Tests 24

EDITORIAL AND NEWS:

- Motor Trucks and the Railways 25
- Kansas Automobile Owners Get Behind Good Roads Movement 25
- Truck Regulation in Wisconsin 26
- Road Building in Canada 26
- Accidents Increase as Roads Improve 26
- Economic Survey of Roads in Tennessee Published. 26
- Engineering Societies Maintain Employment Service 26

EQUIPMENT—TRADE—MATERIAL:

- Addition to Road Maintenance Equipment . . . 27
- A Truck Turntable for the Road Contractor . . 27
- Trade Publication 27

MEETINGS: 28

PERSONAL MENTION 28

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WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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New Concrete Bridge in Southwest

Oklahoma-Arkansas Bridge Crossing the Arkansas River at Fort Smith, Ark., Contains Largest Concrete Spans in the World

An important link in interstate communication in the Southwest was completed early this season when the free bridge over the Arkansas River at Fort Smith, Ark., was dedicated and opened to traffic. The new bridge connects the states of Arkansas and Oklahoma and forms part of the Sequoyah Trail running north and south through western Oklahoma and the Albert Pike Highway which extends from Hot Springs, Arkansas., to Colorado Springs, Col. Over it will pass all the traffic which originates in the Arkansas Valley and also a great deal of through traffic to states further south and southwest. It is therefore of importance not only to the people of Arkansas and Oklahoma but to the whole country as a part of our great highway system.

In addition to its value to motor traffic in the Southwest, the new structure is of interest as being one of the largest reinforced concrete bridges in the country and because the two high spans are the largest concrete spans ever put into a bridge.

The length of the bridge, 3,252 ft. of concrete structure, was made necessary by the nature of the Arkansas River, a tiny stream in the midst of miles of sand in the summer and a raging torrent covering the lowlands for miles in flood season. The two high spans were built to accommodate theoretical steamboats for the time when the Arkansas will become a navigable river. These spans are 212 1-3 ft. in length, 194 ft. in the clear, and have a water-way clearance above normal water line of 76 ft. The remaining 14 spans are each 146.5 ft. in length. The bridge is 41 ft. wide and has a 28-ft. roadway with a 5-ft. concrete sidewalk on each side. The roadway is paved with asphalt. The bridge contains 20,000 cu. yd. of concrete and 784 tons of reinforcing steel.

VIEW OF THE MAIN SPANS

VIEW OF APPROACH TO BRIDGE

The total cost of this new structure was $1,090,000 with the exception of $100,000 from the federal government and $50,000 from Sequoyah County, Oklahoma, the entire cost was paid under a special taxing district plan. The city of Fort Smith was declared a special tax district by act of legislature in 1913 and the benefits were taxed against the property and paid as a direct tax. The actual funds, however, were raised by a $1,000,000 bond issue, the bonds to be redeemed within 25 years.

The original contract for the work was let to M. M.

Elkins and Company in January, 1919, and shortly afterwards construction was started on the approach at Fort Smith. The bridge was designed by Hedrick & Hedrick of Kansas City, Mo., and they also supervised the construction. In April, 1920, the contractors suspended work and abandoned the contract. In July of the same year, the contract for completing the work was awarded to the Missouri Bridge and Iron Works and the job was pressed steadily to completion early this season.

Recent Progress in Highway Research[*]

By DR. W. K. HATT[†]

At the meeting of the American Society of Civil Engineers, at Asheville, N. C., some twenty years ago, the writer outlined the contemplated program of the timber investigations of the Forest Service, U. S. Department of Agriculture. Since that time these researches into the properties of wood, and the technology of its preparation for the market, first at several scattered laboratories, and then more effectively at the Forest Products Laboratory at Madison, Wisconsin, have securely founded this branch of science. The necessary condition of success was obtained, when the problem was approached by a coordinated staff of engineers, chemists, physicists and histologists.

It appears that an early solution to the more complicated, and, from the standpoint of national wellbeing, more grave problems of highway transport, will be reached only in so far as the highway engineer, the highway official, the vehicle designer and manufacturer, and the organizer and operator of highway transport systems, can in conference come to an understanding of the aims of each other, and to a recognition of the public service to which they are called. To this group should be added also steam and electric railway operators, so that highway transport may find its appropriate function in a coordinated structure of national transportation.

Happily the highway engineers and the motor vehicle manufacturers are now seeking a common viewpoint, and are in the way of finding a common purpose from which to reach sound policies in the financing, building and use of highways. May we not hope for the contribution of those representing other systems of transportation to a scientific study of these questions.

Need for Scientific Research

I submit that we must move from the field of opinionated discussion into the field of judgment, through data secured by scientific research. Many more traffic, or rather highway transport surveys, such as those under way in Massachusetts and Connecticut, are needed for a visualization of this activity, and for a prediction of the future needs for highways and terminals for its accommodation.

There is new wine in old skins. We have inherited many ideas from a use of highways, not far removed in time but different in nature and so very small compared to that of the present time. The recognition by engineers and economists of the essentially different roles played in highway financing by the several elements of the highway right-of-way, grading, structure and surfacing—this distinction so obvious when presented, is new to many intelligent minds. That the highway is an investment, and that the measure of accomplishment is not the building of mileage, but the resulting reduction in the costs of transportation, is a conception that is needed to clarify discussion. Almost everyone is a first-hand observer of highways, and there is here a splendid opportunity for the education of an interested public.

It is not my purpose today to discuss national problems of highway transport. The time will be most profitably used in illustrating typical researches which operate not only in the fields of materials of construction, so long and patiently occupied hitherto, but in traffic surveys, measurements of operating costs, and tractive resistance. The action of the vehicle on the road and the design of the surface and base to carry these loads over determined subgrades.

Confusion of Organizations

However, I must first comment upon the confused assemblage of organizations and committees active in the field of highway transport research and regulation. One aspect of science is a simplification and economy of thought, and one aspect of engineering is economy of action. In highway matters, as in general engineering, a service would be rendered by some organization which would analyze the functions of committees and inquire into the duplication of function and the overlapping of the field of effort. A list of 24 organizations interested in the technical aspect of highways will serve to indicate the potential energy of workers prepared by experience and motivated by desire.

Some consideration of the activities of committees of technical organizations in general may disclose a too heavy assignment of one individual to numerous committees. We should distinguish between those committees that pass judgment upon prepared evidence, and those that are expected industrially to gather and to formulate evidence.

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[*] Paper presented at meeting of Society of Automotive Engineers, June 23 and American Society of Civil Engineers, June 21.

[†] Director of Advisory Board on Highway Research, Division of Engineering, National Research Council.

Some of our highway committee problems are so important that organizations, governmental or industrial, would be justified in assigning an individual for full service to the work of his committee. How can a man who has full responsibilities to discharge and duties to perform at home, give adequate attention to committee work? And so a stellar committee roster may be imposing potentially, but of little kinetic energy.

Co-ordination of Research

The Advisory Board on Highway Research, Division of Engineering, National Research Council, is organized to prepare a comprehensive national program for highway research; to assist existing organizations to coordinate their activities therein; and to collect and distribute information of completed and current research. This is not a directing, but a service organization, devoted to the interest of the individual researcher who instinctively resents interference from overhead desk men, and properly guards with care the products of his zealous research. Services that can be rendered the individual researcher are in soliciting support for his subjects, in putting him in touch with his fellow workers through a census of research, and in illuminating a particular field with side lights from allied fields in which a project has its setting. The taxpayer will also benefit through a co-ordinated research activity on problems selected from a comprehensive program with reference to the applicability to present day problems.

A Few Examples

Highway researches in the field of economics of operation are connected under the Committee on the Economic Theory of Highway Improvement, Professor T. R. Agg, chairman. In New England the tractive resistance of automobiles and trucks is being measured on several types of roads at speeds up to 30 mi. per hour. The vehicles are tested for internal absorption of energy at the Yale laboratory by Professor E. H. Lockwood, and the gross tractive resistance determined on the roads by Major Mark L. Ireland, Q. M. C., who is stationed at the Massachusetts Institute of Technology. Co-operating in this work are:

Bureau of Public Roads, U. S. Dept. of Agriculture,
Committee on Economic Theory of Highway Improvement, National Research Council,
Connecticut Highway Commission,
Department of Public Works, Commonwealth of Mass.,
Harvard University,
Massachusetts Institute of Technology,
Society of Automotive Engineers,
United States Army Q. M. C. Department,
Yale University,

The investigation includes the effect upon tractive resistance of the temperature of the differential of the vehicles, and of various types of tires. Of course the gross tractive resistance is composed of several elements, such as engine, gearing, inelastic resistance of body, tire, windage, road surface, which distinguishes rolling, impact and displacement resistance. Account must be taken of the absorption and giving out of energy in the rotating parts, in accelerating or retarding speed. The technique of these measurements is not settled. The measuring instruments may be an accelerometer used in coasting tests, or a dynamometer, in towing tests each of which has its peculiar advantages. The first task is to determine the best instrument to measure the several elements into which the problem is analyzed. The Bureau of Standards has assembled apparatus at a remarkable degree of completeness and perfection, which automatically records the measurements of some fourteen elements of car performance in road tests.

Professor L. E. Conrad, at Manhattan, Kansas, is conducting a parallel investigation of the resistance of the air to the passage of vehicles.

At the University of Michigan Professor Lay in a study of economic grades has towed four Packard trucks over gravel and concrete roads, after he had determined their characteristics in the laboratory. The gravel roads varied in condition from wind-swept hard surfaces to a loose gravel surface. The concrete road varied from a very smooth finish to a more or less wavy condition. The gasoline consumption was also reported. The trucks were 5-ton with 3-ton pay load, and were run at a standard engine speed of 1,000 R. P. M., the gears being shifted to meet road conditions. Professor Lay finds that for these trucks the tractive resistance, including rolling resistance, tire resistance and windage, varied from 40 to 44 lb. per ton on the gravel roads, and from 22 to 26 lb. per ton on the concrete roads, all at a speed of 10 mi. per hour. Professor Lay's report, shortly to be published, is a notable contribution.

At Ames, Iowa, Professor T. R. Agg has been investigating for a long time the economics of highway location and operation, especially with a view to determining economic grades, and his report is expected to be published by January, 1923.

The end in view is a sound economic theory of highway location and improvement.

Now, each of these investigations forms part of a whole. The individual researches profit by intercommunication, and in the end the entire results are more likely to be useful in the formation of principles by a co-ordinating service.

Again, in the field of design we may instance the experimental road at Pittsburg, California and the Bates test road near Springfield, Illinois, investigations of Mr. Goldbeck, of the Bureau of Roads, and the service test roads at Byberry, Pa., Lancaster, Pa., Casper, Wyo., Alexandria County, Va., Wilmington, Del., and Milwaukee, Wis., all of which are directed to the same end and will yield a body of co-ordinated data flowing through the channel of the Committee on Design and will place the mechanics of slab design on a scientific foundation.

Again, in the field of highway transport, the pioneer transport surveys on the Connecticut roads, inaugurated by Commissioner Charles J. Bennett, have crystallized formerly vague discussions, and have stimulated further work. The examinations by Dean A N. Johnson of the University of Maryland, by Professor N. W. Dougherty, of the University of Tennessee, by Professor T. R. Agg, by the Bureau of Public Roads in California, and less complete traffic counts in scores of instances—all of these need to be reported and examined for fundamental laws of traffic by a committee on Traffic Analysis.

A useful and money saving activity is in the Research Information Service of the Advisory Board, by which an individual state is informed of the findings from investigations in another state. Cases can be cited in which one state has been saved the delay and cost of investigation relating to the use of materials, when informed of the completed investigation available from the work of another state. The recent tabulation of the incomplete returns of the Highway Research Census of the Advisory Board indicates not only a large activity in this field in the 430 projects, but the possibility of economy in time and money and the avoidance of unnecessary duplication.

Number of Individual Research Projects in Highway Engineering and Highway Transport

	Economics	Operation	Design (road)	Construction	Materials	Total
Colleges and Univ..	17	3	47	12	127	206
Industrial	1	1	3	0	19	24
Municipalities	5	1	6	1	18	31
State Highway Dept.	13	2	25	8	101	149
State Geologists.....	0	0	3	0	17	20
Total	36	7	84	21	282	430

It must be said, however, that duplication is not necessarily an evil; indeed it is useful in fundamental matters, as in the case of the investigation of fatigue of concrete. The parallel investigations at Springfield, Illinois, Purdue University and the University of Maryland, with different methods of attack, will more certainly lead to the truth. However, in these cases each will profit by communication with the other.

Mr. H. S. Mattimore, Engineer of Tests, State Highway Department, Harrisburg, Penn., is chairman of the Committee of the Advisory Board on the Character and Use of Road Materials, also chairman of the Committee of Tests and Investigations of the American Association of State Highway Officials. The latter committee is divided into sub-committees, each representing a region of the United States. Mr. Mattimore is furnished by the Advisory Board with an administrative assistant, and this combined attack on problems relaing to the materials of construction represents a well organized committee activity.

These few instances will serve to demonstrate the value of the services of the Advisory Board in tying together individual researches.

ILLINOIS DIVISION OF HIGHWAYS REPORTS ON BATES ROAD TESTS

Though delayed to some extent by maintenance troubles, the run of the fifth increment of load on the Bates road was completed in the morning of July 1. As in three of the preceding runs, 3,000 applications of the load were made; 2,000 in the daytime and 1,000 at night. The load used in this run was 6,500 lb. on each of the rear wheels and 1,800 lb. on each of the front wheels. The same trucks were used as in all preceding runs, brick piled in the boxes and held in place by 2 by 4 lumber, making up the necessary load. The load as applied corresponded to 650 lb. per in. of nominal width of rear tire, and 360 lb. per in. of width of front tire.

Again a variation in time of application of loads was made in this run. The night traffic started off the test, with the day traffic completing the run. The path of traffic with this load was exactly the same as in the last run, the trucks traveling 2.5 ft. in on the north side and directly on the edge of the south side of the pavements.

Due to the large number of failures in some of the lighter sections it was necessary to halt traffic at various times during this run and maintain the sections. At certain places the pavements were broken to such an extent that the trucks were unable to travel through them. The paving surfaces in these sections were entirely removed and were replaced by novaculite which when pounded down presents a comparatively smooth path of travel. In one section of monolithic brick it was necessary to use over two carloads of novaculite before traffic could be maintained with any degree of efficiency.

Under the load of 6,500 lb. it was expected that most of the 5-in. sections would show failures as this load applied 6 in. from the corner produces a stress of 600 lb. if the corners are considered as unsupported cantilevers. Failures were also expected in some of the 6-in. sections as a stress of 400 lb. is secured with this load applied at free corners.

Practically every one of the lighter sections have completely failed under the loads that have been applied to date and these loads are well under the legal load allowed in this state.

The load now being applied is 8,000 lb. on each of the wheels and 1,930 lb. on each of the front wheels. As this load is the legal limit for this state it is intended to make 10,000 applications so that a thorough test can be given all the remaining sections. It is probable that 5,000 applications will be made during the day and 5,000 at night. It is expected that this run will extend over six weeks' time as the maintenance of the sections will undoubtedly present a complicated problem.

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. L. POWERS
Editor

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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MOTOR TRUCKS AND THE RAILWAYS

A news bulletin sent out by the Society of Automotive Engineers contains an article by the president of the society, B. B. Bachman, Chief Engineer of The Autocar Company on the relation between steam and electric rail lines and motor truck transportation. In the closing paragraph he sets forth the final argument of the motor interests on the subject of taxing the motor vehicles to pay for the roads:

> "Much of the discussion on the question as to who should bear the burden of the cost of construction and maintenance of our highway systems or whether the motor-vehicle operator is receiving a public subsidy which is not shared by the railroad, etc., appears to be beside the point. The cost of transportation of passengers and freight, by railroad, water or highway, is borne by the whole community and shared by every citizen in proportion to his requirements for transportation.
>
> "I believe this to be so, whether the cost of transportation is included in the cost of the commodity or it appears partially in the form of taxes. The big fundamental problem is to determine the economic field for each medium of transportation and the relation each should bear to the other for maximum efficiency, and the most satisfactory means of proportioning the expense to the individual."

It is undoubtedly true that the consumer would pay indirectly for the roads in increased transportation charges if the burden of highway costs were shifted to a greater extent upon the motor trucks. However, it would seem to be a more equitable means of apportioning the expense to thus tax each citizen in proportion to his requirements for transportation. Besides that, the costs of transportation are largely governed by competition. Where transportation of passengers and freight is possible by rail, water or highway, the water rates are made just enough lower than the rail rates to get the business. The motor trucks carrying freight on short hauls in competition with rail and water make their rates enough lower than the rates by water to attract the shipper. Thus the charges for hauling freight are not governed by the cost of transportation by truck but by the cost of transportation by rail. The railroads own and maintain their own right-of-way. The motor trucks use the public highways. The citizen, taxpayer, whatever you wish to call him, who pays the costs eventually would be fairer treated if the motor trucks were made to pay for the highways at least up to a point where they would be competing on equal terms with the railways. As it stands now, he might be paying more for transportation by truck than would be necessary if the rates were based on cost of transportation instead of on a slight cut under the railroad rates. Certainly no one wants to tax the motor trucks off the roads but perhaps they could be taxed a great deal more than they are now before that point would be reached.

KANSAS AUTOMOBILE OWNERS GET BEHIND GOOD ROADS MOVEMENT

Kansas is one of the states of the Union whose constitutional limitations put them in peril of losing federal aid for road construction because under the present law the state can not act as a unit in matching federal-aid funds. The Federal Aid Act of 1921 extended to such states a three-year period of grace in which to pass amendments to their constitutions. They are now faced with the necessity of taking action in 1923 or losing federal aid after November, 1924. In Kansas the constitutional amendment must be submitted to the people by the next legislature. With these facts before them, a state-wide meeting of automobile owners was held in Topeka and the Kansas Automobile Owners' Association was organized to get behind a good roads program to meet this situation. The program is outlined as follows:

The 1923 Legislature to submit a constitutional amendment providing:

1. A state-wide system of highways of approximately 6,575 mi. of roads.
2. Authority for a $60,000,000 bond issue to meet the cost.
3. Exempt motor vehicles from property tax, and use license fees to pay cost of these bonds, both interest and retirement.
4. Reimbursement at value when law becomes effective to all counties, townships and districts for improvements on roads taken over by the states, said money, except the district portion, to be used on other road improvement.

TRUCK REGULATION IN WISCONSIN

A peculiar feature of the law enacted by the 1921 legislature of Wisconsin to limit the weight of vehicles using the highways of the state is the clause that divides the roads into two classes. On class A roads, trucks with a combined weight of vehicle and load of 12 tons may travel, while on class B roads the total weight with load is limited to 7½ tons. The law further provides that the weight of the vehicle, the actual advertised carrying capacity of the truck and the toal weight of truck and load must be lettered on the side in plain visible print. Failure to observe this provision subjects the owner to a fine of not less than $10 nor more than $25 for each offense. Automobile inspectors have been instructed to begin making arrests generally for violations of the law.

ROAD BUILDING BOOM IN CANADA

Reports to Highways Information Service, New York, from the various Canadian provinces for June 1922 show contracts for new roads and streets let during that month to the value of $3,774,200. The total number of contracts let was 72. New projects reported under consideration numbered 146 and were to cost $4,697,600. The value of the new construction contracted for during June in each province was as follows: Ontario, $1,664,900; Quebec, $822,000; New Brunswick, $151,900; Nova Scotia, $115,000; British Columbia, $383,300; Alberta, $16,500; Saskatchewan, $26,000; Manitoba, $47,400.

ACCIDENTS INCREASE AS ROADS IMPROVE

The Minnesota Highway Department is warning the people of the state by means of bulletins to the daily press that the lure of speed on broad smooth, straightaway sections of the highway system is fast running up accident totals with the railroad grade crossings, sharp turns and other dangerous secitons which the department is making every effort to make safe. Although the state is working to make the roads 100 per cent safe, it is evident from the large percentage of accidents where conditions are nearly perfect that the first essential to highway safety is careful driving.

This same fact has been discovered by many state highway departments. New York, for instance, can point to the straight road between Albany and Schenectady as the scene of more accidents than perhaps any other stretch of road in the state. Wherever there have been many hard surfaced roads built, records show an alarming number of accidents where none should occur if the straightaway was not tempting the careless driver to speed.

The effort which the Minnesota Highway Department is making to remedy the situation by bringing it to the attention of the people day after day in their home-town newspapers is a credit to that most progressive organization and a sample of the work that is done by their highly developed publicity department.

ECONOMIC SURVEY OF ROADS IN TENNESSEE PUBLISHED

"Highway Economics and Highway Transport in Typical Counties of Tennessee," by Prof. N. W. Dougherty, has been issued as Bulletin No. 1 of the Engineering Experiment Station of the University of Tennessee. The bulletin is a report on a cooperative survey by the University of Tennessee, the U. S. Bureau of Public Roads, the Tennessee State Highway Department and county authorities, during the summer of 1921, in four counties of Tennessee. The object of the survey was to secure information on highway economics of interest to highway officials in general and to lay before the people of particular counties a statement of the present condition and cost of their highways, maintenance costs and the probable cost of improving the system to meet present and future needs, as a basis for future development.

Existing systems of the counties were inspected and the roads classified according to type and condition and records of cost obtained. Maintenance methods and costs were also investigated. A number of traffic counts were made on roads of various degrees of importance and information as to farm values and production secured. From these data, necessary improvements to meet the needs of present traffic and that of the near future were outlined and an estimate made of the necessary expenditure.

The bulletin does not give details of the data collected but gives gross figures to support the conclusions drawn. It discusses factors governing selection of type of pavement, relation of traffic to highway expenditures and the necessity of planning so that all needs will be cared for in the most economical way.

ENGINEERING SOCIETIES MAINTAIN EMPLOYMENT SERVICE

The four national engineering societies, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers, which form the Federated American Engineering Societies with offices at 29 West 39th St., New York City, maintain a free employment bureau which they strive to make a national clearing house for engineering talent of all kinds. The bureau, through its manager, Mr. Walter V. Brown, has advised the American Road Builders Association that members of that association who are officials of or connected with organizations in which a central personnel department is not maintained are at this time given a most cordial invitation to make free use of the bureau by advising the various departments in their organizations of the existence and usefulness of the Engineering Societies Employment Service. The bureau is in a position to furnish highway engineers and superintendents of construction for road work.

Equipment — Trade — Materials

ADDITION TO ROAD MAINTENANCE EQUIPMENT

The ever-increasing importance given to highway maintenance and the adoption by many states of individual patrol systems has led to the development of special machinery for that type of work. The Road Repair Equipment Company, 165 Broadway, New York, has recently placed upon the market an improved portable heater for road repair work. This heater is entirely a one-man machine; one man can operate the heater, mix the material and put material in the hole to be patched. The heater, similar to a wheelbarrow in design, is of steel construction and weighs about 95 lb. The gasoline tank has sufficient capacity to burn 10 continuous hours. The heater will hold 4 cu. ft. of material and will have the material at the boiling point about five minutes after the flame is lighted. If the penetration method is used, a cover comes with the heater which fits snugly over the top and a nozzle is attached to the side from which the material may be drawn. While this machine was built primarily for the use of patrolmen on state highways, it can also be used to advantage on the streets of small communities where there is no central heating plant.

ONE-MAN PORTABLE HEATER

TRADE PUBLICATIONS

The most recent publication of the Hercules Powder Co. of Wilmington, Del., is a 56 page illustrated book entitled, "Eliminating Waste in Blasting." It tells how some progressive companies are preventing blasting waste and also contains recommendations of the Hercules Company. It is planned to supplement this book with bulletins from time to time and thus give users of explosives the benefit of the information the company has been able to gather on the best methods of reducing blasting costs.

* * * * * * * * * *

The Truscon Laboratories, Detroit, Mich., have prepared and have ready for distribution a handbook of specifications for architects and engineers. The book is in loose leaf form as that was considered the form most adaptable to field and office use. A complete index of specifications arranged under appropriate headings is given at the beginning of the book and as far as possible each specification is confined to one page. The book contains 108 pages, size $8\frac{1}{2}$ x 11.

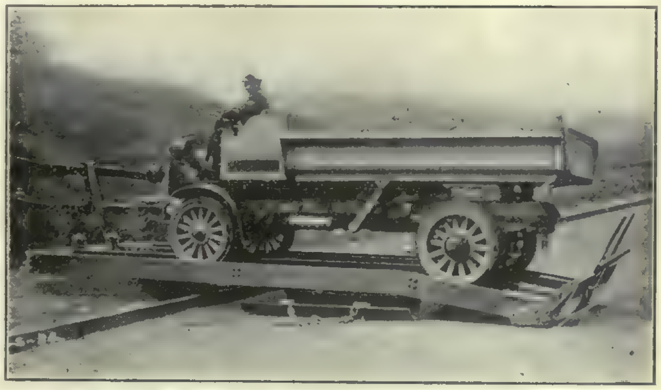
* * * * * * * * * *

Seven models of Acme motor trucks are described in the 1922 catalogue of the Acme Motor Truck Company of Cadillac, Mich. Attention is also given to various types of bodies, the Acme power plant and the driving mechanism. This 40-page booklet with its many illustrations is a singularly substantial and attractive publication.

A TRUCK TURNTABLE FOR THE ROAD CONTRACTOR

Built in turntables for changing the position of ponderous mechanism have been in vogue for a number of years, but it has remained for the Blaw-Knox Company of Pittsburgh, Pa., to develop a practicable turntable having mobile characteristics for the use of the road contractor.

There are several essentials which a turntable must have to render its use of the greatest economy to the road builder. To begin with it must be arranged to handle trucks up to 5 ton size and having wheelbase measurements up to and including 168 in. When road building conditions are considered it must be borne in mind that the width (overall) of the turntable must be such that it does not take up more than 8 ft. of roadway when truck is mounting or backing off. Such a turntable must be capable of turning over the road-forms to secure maximum efficiency from its operation.



BLAW-KNOX TRUCK TURNTABLE

The turntable illustrated above is designed to incorporate these characteristics and more. It moves on a skid which does not damage the finished subgrade. It enables trucks to be turned within easy backing distance of the paver. It saves the finished subgrade. It saves time in turning and increases hauling speed between the scene of the job and its base of supply.

The manufacturers quote instances of recorded performances in which the turntable has shown savings of between $40.00 and $52.00 per working day where fleets of trucks running between 12 and 20 in number were used. These turntables are made in 2½, 3 and 5 ton sizes all of which are easily operated by one man.

MEETINGS

Calendar of Coming Meetings

August 4-5, Texas Highway Association—General convention at Galveston, Texas. Secretary-treasurer, Room 1910, F. & M. Bank Bldg., Fort Worth, Texas.

Aug. 9-10—Custer Battlefield Highway Association—Annual meeting, Sheridan, Wyo. Secretary, W. D. Fisher, Sheridan, Wyo.

Oct. 2-6—American Society for Municipal Improvements—Annual convention, Cleveland, O. Secretary, Charles Carroll Brown, St. Petersburg, Fla. ,

A. S. T. M. HOLDS ANNUAL MEETING

The twenty-fifth annual meeting of the American Society for Testing Materials held at Atlantic City, N. J., June 27-30 was a very successful one and by far the largest in the history of the society. There were 626 members in attendance or represented and 116 guests and 172 ladies brought the total to 914, which is about fifty more than the largest previous meeting. The program, too, was larger than ever before and necessitated twelve sessions instead of ten, simultaneous sessions being held on Thursday evening and Friday morning. All the sessions were exceptionally well attended. The first action of the meeting was the election of officers and that was reported in our issue of June 28.

The Thursday morning session was devoted to concrete aggregates, road materials and waterproofing. The report of the committee on concrete and concrete aggregates, A. T. Goldbeck, chairman, was presented by the secretary, J. C. Pierson, and adopted by the meeting in the absence of the chairman, A. H. Blanchard, the report of the committee on road and paving materials was read by C. N. Forrest who also presented the report of the committee on waterproofing materials. Both reports were adopted after they had been amended. The following papers were presented at the session by their respective authors: "The Use of Excess Sand and Pit-Run Gravel in Concrete Pavements," by R. W. Crum; "Physical Properties of Subgrade Materials," by J. R. Boyd; "An Impact Test for Gravel," by F. H. Jackson.

PERSONAL MENTION

Joseph Allen of Shell Lake has been appointed county highway commissioner of Washburn County, Wisconsin.

John Ferris has resigned from the position of highway commissioner of New Jersey.

Everett W. Nice has been appointed city engineer of Flint, Mich., to succeed E. C. Shoecraft.

W. C. Earle has been appointed city engineer and superintendent of streets of Pasadena, Cal.

Harry W. Phillips has been appointed superintendent of construction for the city of Davenport, Ia.

W. C. Earle has been appointed city engineer of Pasadena, Cal.

John H. Dunlap, Professor of Hydraulic and Sanitary Engineering, State University of Iowa, was elected secretary of the American Society of Civil Engineers at the annual meeting at Portsmouth, June 21-22. He succeeds Elbert M. Chandler who has been acting secretary. Prof. Dunlap was born at Harrisville, N. H., Sept. 9, 1882. He was graduated from Dartmouth College in the class of 1905 and received his C. E. degree from the graduate school of engineering three years later. After graduation, he joined the faculty of the State University of Iowa as instructor and has been promoted to the position he now holds. In addition to his university work, Prof. Dunlap has devoted part of his time since 1915 to private practice as a civil and sanitary engineer.

Extensive road construction and reconstruction is planned in France. The repair of many of the 28,000 mi. of highways has been made necessary as a result of the war traffic and the increasing volume of motor transport since the war. Paris also contemplates repairing many miles of streets.

LOUISVILLE CONTRACTORS BID ON SEWERS

A notice in our issue of June 21 told of the refusal of Louisville contractors to bid on a $1,000,000 sewer contract because of a clause therein which made the sewerage commission's engineer's decision final and binding on both parties to the contract. A second letting was advertised and the contractors bid on the work after they had come to an agreement with the commissioners. The commissioners admitted that the form of contract was faulty and agreed that the contractors could appeal to them from the decisions of the engineer. The statement of the Kentucky Association of Highway Contractors indicates that the agreement in this case was based on the confidence in the fairness of the members of the sewerage commission and does not mean that they have permanently abandoned their original position.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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TABLE OF CONTENTS

The New Attica Bridge 29
Tractire Resistance of Roads Studied 33
Road Officials Consider Linking Up State Systems . 33
Trucks Denied Use of Highway 33
Government Small Expenditure for Roads 34
Radio to Aid Road Builders 34
N. J. Completes Best Section of Lincoln Highway 34
Federal Aid to Road in Public Land States . . . 34
Equipment—Trade—Material 35
News 36

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII. NEW YORK, N. Y., JULY 26, 1922 Number 4

The New Attica Bridge

Details of Design and Construction of Bridge Over the Wabash River at Attica, Indiana, Recently Completed—Largest Reinforced Concrete Bridge on a State Highway in the Middle West

By H. A. HANAPEL[†]

This bridge, an important link in the transportation facilities of the State of Indiana, crosses the Wabash River at the foot of Mill Street at Attica, Franklin County. The old structure, built in 1886, consisted of two pony approach spans and five through trusses, total length 804 ft. The substructure consisted of stone piers.

On account of the large amount of traffic, both through and local, the light superstructure had been greatly overstressed and was found inadequate to safely carry the loads. The floor system, being made up of wood stringers with a plank runway, was a source of great annoyance and danger to the traffic and an item of great expense to the county for maintenance. The substructure was in fair shape, but it was evident that the foundations did not extend much below the bed of the stream, if at all.

It was realized for a number of years by the public as well as the local officials that it would be necessary to do something in order to continue to handle the traffic safely. The matter of repairing the old structure was investigated, however, and it did not appear to be economical to attempt to use any part of it. The members of the trusses were not heavy enough to permit increasing the dead load by using steel stringers and adding a corner to floor. Besides the old steel showed evidence of being crystallized and therefore unfit for further use. The entire structure had outlived its usefulness.

After due deliberation on the part of the county officials, it was decided to build a new structure on the upstream side of the old one and as near to the latter as conditions would permit. Of all of the designs submitted, the one by Mr. Wm. J. Titus, Bridge Engineer of the Indiana State Highway Commission, was accepted as being the most economical and the best suited to the natural conditions. The contract was awarded to Standish and Allan of Chicago on February 7, 1920, on a unit price basis for the sum of $272,000.

The design is a six span reinforced concrete arch, total length 986 ft, The individual spans vary in length from 135 ft. to 150 ft. clear opening, having a rise of 16 ft. 3.5 in. to 19 ft. 11 in. The arches are solid, with 12-in. sidewalls and counterforts supporting cantilevered brackets and a 6-in. sidewalk. The roadway provides a 20-ft. driveway, curb to curb, with a 5-ft. clear sidewalk on each side.

Foundations

The contractor started work in August, 1920, at the east end of the structure. The material excavated was an old cinder fill to an elevation 5 ft. above low water level, and a coarse gravel from this elevation to the final foundation. The contractor rigged up a mule traveler at this foundation and used it to drive the Wakefield sheeting and foundation piling. A total of 88 piles aggregating 2,015.7 lin. ft. below cutoff (they were allowed to project 18 in. into the concrete) were driven.

After completing this foundation, the mule traveler was moved out to the first pier, at the east edge of the water, and open dredged the hole before the cofferdam was placd. This foundation was carried down 13 ft. below low water through a hard cemented gravel, and then 117 piles, aggregating 2,123.9 lin. ft., were driven by means of a follower made out of a hickory pile with a 30-in. wrought iron pipe at one end. A Vulcan No. 2 steam hammer was used throughout. After the piling was all driven, the contractor received permission to seal the hole without unwatering it. In an attempt to use a tremie, the gang made a complete failure of it, and after about 10 or 12 yds. were placed the work was rejected and the contractor was ordered to unwater the hole and remove all of concrete poured.

The following pumps were then set up at the foundation: One 8x6-in. centrifugal, one 10-in. double suction centrifugal, and a 7-in. Nye. The first two mentioned did not work properly and the three together could not unwater the hole. A 14x12-in. electric pump was then set up and it unwatered the hole in 20 minutes. About this time the river, which had been at a low stage, started rising, and the 20-ft. Wakefield sheeting was found to be too short, therefore it became necessary to build a puddle dam 4 ft. high above the sheeting. The contractor had built the cofferdam the same size as the concrete lines of the footing and in not driving the sheeting far enough below the footing elevation to get a foothold, a great deal of trouble was experienced in keeping the sheeting from bowing in at the bottom. This naturally caused a great deal of water to come into the hole, and the bottom seepage also was considerable. After a great deal of grief along the above mentioned lines the first concrete was finally poured Jan. 31, 1921.

[†] Resident engineer in charge for the Indiana State Highway Commission.

Excavating Work

In the meantime the contractor assembled a 40-ton steam derrick at the site of the west abutment and started excavating about Oct. 25, 1920. He used 10-ft. Wakefield sheeting and experienced no trouble in unwatering this hole with a 7-in. Nye pump. The subsoil encountered was a very good grade of gravel in the front half of the abutment and a poor grade in rear half. To overcome this, 13 additional foundation piling were driven, making a total of 104, aggregating 1,746 lin. ft. The first concrete was poured with a tremie at a great cost to the contractor, about Jan. 10, 1921.

The steel derrick was then moved east to the last pier, designated. The contractor again used 20-ft. Wakefield sheeting and attempted to carry down the excavation as the sheeting was driven and cofferdam frame settled—that is, a few feet at a time. A sandy clay was encountered for about 20 ft. and then an excellent cemented gravel was found, upon which grade was established. A total number of 117 foundation piles, aggregating 1,872.5 lin. ft., were driven. When the hole was then unwatered, it was found that the sheeting was badly bowed in the southeast and southwest corners, but not enough to warrant rejection of hole. This cofferdam was also built to the exact concrete lines. The first concrete was poured about April 15, 1921, and no further trouble was experienced to build up the shaft of the pier.

During late fall of 1920, the contractor built a barge 22x52 ft. for use in building the river piers and equipped it with a new three-drum American hoist. This piece of equipment was not able to do much work until after the Spring floods, except for light work around the extreme east pier. However, in May, 1921, the second pier from the east end of structure was finally started again. The contractor had dredged this hole about three times and every time he was all prepared to place the cofferdam there was a small rise in the river and the hole completely filled up with silt and sand. The same procedure was followed in sinking this hole as in the previous ones. A total of 118 foundation piling, aggregating 2,083.75 lin. ft., were driven. When the electric pump was set up and hole unwatered, it was found that the bottom of the Wakefield sheeting was bowed in an average of 2 ft. in the south half of the cofferdam. The hole was therefore rejected. Part of this situation was due to the fact that the contractor had driven eight round piling in the southwest corner to stop a leak through the sheeting. Another reason, and the more important one, was that the bottom set of rangers were kept about 6 ft. above grade, and the fact that the sheeting did not have more than a 6-in. toe hold in the gravel gave nothing to take the pressure. The cofferdam, too, had been built to the exact lines of the footing concrete.

At the suggestion of the state engineers, the contractor drove 22-ft. steel sheeting around the south half of the cofferdam on the outside of the Wakefield sheeting, and then the latter were cut off below the bottom ranger. No further trouble was experienced and concrete was poured with a bottom dump bucket.

In the meantime the steel derrick was moved to the second pier from the west edge of the river. Twenty-foot Wakefield sheeting was used and driven only 4 or 5 ft. ahead of the excavation and the cofferdam was settled as the latter proceeded. The hole was kept unwatered at all times and the results proved gratifying. The final cofferdam and sheeting were in excellent shape, practically no leakage through the sides at all. An excellent subsoil of cemented gravel was obtained. A total of 117 foundation piling, aggregating 1,879.2 lin. ft., were driven and completed July 2, 1921. The hole was kept unwatered when footing concrete was poured a few days later. An interesting feature of the driving of the Wakefield sheeting in this hole was the use of a so-called "Jonathan Pole" to guide the steam hammer. In this particular location it permitted speed, together with careful workmanship.

The barge did the work on the last or center pier. The same procedure of open dredging was followed, but the cofferdam was made about 6 in. larger than the footings, and also 22-ft. steel sheet piling was used. This hole was sunk in record time without any difficulty whatever. An excellent subsoil of hard cemented gravel was encountered. The first concrete was poured in August, 1921, with a bottom dump bucket.

Observations from Foundation Work

The footing conditions encountered were ideal in more ways than one. In practically every case an excellent gravel subsoil was encountered capable of safely holding up at least 5 to 6 tons per sq. ft., and the piling also were driven in excellent shape, but somewhat harder than was necessary. It was desired to have at least a 20-ton safe bearing capacity; however, it is the writer's opinion that the average is near 25. This was increased so as to be absolutely sure at all times that every pile would safely carry 20 tons. Due to the fact that most of the piling were driven through about 12 ft. of water by means of a follower, it was more or less necessary to make the thing fool-proof. Even though a cast iron cap was used, it was impossible to keep this follower in good shape because of the enormous amount of punishment it received. From a study made before and after the follower was put on the pile, it appeared that at least 20 per cent of the force of the blow was taken by it. Most of this was due to broomed ends, but a good deal was also due to the fact that the stick was not entirely rigid—that is, had some play, and also because it could not be kept vertical.

After piling were all driven and holes unwatered, it was found that the original locations had been kept very well and most of the piling were driven just about as indicated on the plan. It was found, however, that driving through water is a task that gives deceiving results, and therefore requires a good deal of attention.

Piers and Arches

After foundations were poured, the forms for the shafts of the piers were built to the bottom of the coping, approximately 19 ft. 10 in., and the concrete poured. After this the coping, umbrella tops, skewbacks and 1-ft. spandrel were poured in one operation. Sufficient keyways and horizontal surfaces were left on the top of the skew backs in the counterfort locations, and this was also finished on top to give drainage to the intakes of three 4-in. cast iron pipes that discharge into the river on the sides of the pier. It was found to be a very difficult task to build the umbrella tops to the correct lines and grades; therefore, after three complete caps had been poured with non-gratifying results, it was decided to get the centering adjacent to the piers in position first, and then it became more of an easy matter to build the forms and hold them.

Before all of the foundation work was complete, the contractor had started the driving of the false work piling for the arch centering. Those on the east side of the river were driven with a mule traveler, the barge drove those in the river and the steel derrick those on the west bank. The centering for one-half of each arch was laid out in the yard, marked and cut, and therefore was in good shape to put into position. This centering was designed so that it would not act as a truss, but instead to transmit the load directly to each pile bent, which were at about 22-ft. centers.

It was decided to pour the south half of the arches first, thus putting in a longitudinal construction joint through the center line of the bridge. In addition to the great amount of transverse reinforcing steel, a large number of keyways were put in on the vertical surface of the joint which assured that the two completed halves would act as unit.

The first two halves on the east side were first poured, the last two on the west end next and the two intermediate followed soon after. It was found that there was some settlement, maximum being about 2 in. in each case. Some of this was due to the joints of the centering tightening up and more of it to the settlement of the piling.

A longitudinal keyway, 4 in. wide and 3 in. deep, was put in the extrados of the arches flush with the inside of the spandrel walls, and sufficient keyways were placed in the base of the counterforts to take the shear caused by the thrust of the earth fill against the spandrel walls. In each case, that part of the curb and gutter and the few cantilevered brackets over the crowns of the arches were poured the day following the pouring of the arches, so as to insure a bond between the two piers. The intermediate 12-in spandrel walls, including curb and gutter and cantilevered brackets, were poured later.

As indicated on the plans, an expansion joint filled with a ¼-in. tarred felt was put in between spandrel walls over arches and those over the piers, a construction joint was put in between outed edge of 8in. curb and sidewalk, and the top of every second cantilevered bracket at point where sidewalk joints were made was painted with a water-proofing compound. This was all done to permit proper expansion and contraction due to the rise and fall of the arches.

After the south half of the arches were poured, the question of proper lowering of centering came up and it was decided that, due to the fact that entire structure acted as a unit, it would be folly to attempt to release the center-share of the load. The contractor therefore was permitted to strike the centering of an arch 30 days after it was poured, provided the adjacent one had been poured 30 days, the second one two weeks and the rest at last one week. This procedure was then carried out.

The lowering was done by means of 12-in. hardwood wedges that had been placed under centering on the top of the pile caps. In some cases the center wedges were lowered first and the work proceeded toward the two ends; in others it was done from the ends toward the middle. No advantage was discovered in the use of either method; however, the greatest care was taken at all times to lower the entire centering gradually. The wedges under several arches were found to be very tight, due to contraction of arches caused by cooler weather.

The North Section

It was the contractor's plan to re-use this centering as a unit for the north half of the structure. It was therefore built very substantial and solid, and no trouble was experienced in dragging it into position. This was done by placing 4-in. rollers under each panel on the top of the pile caps ing of one arch until the other ones were ready to take their and then pulling into position by means of three crabs fastened to the ends and centers. Great care was exercised to see that the entire centering was moved evenly and at the same rate of speed. It was then jacked up and wedges placed underneath. The lagging was permitted to extend 2 ft. beyond the construction joint at the center line of bridge and then jacked up as tight as possible against the intrados of the arch. The outer end then was brought up ¾-in. above this elevation. This was done to take care of uneven settlement caused by the fact that the end was not jacked up as tightly as the part next to the arch already poured.

It is interesting to know that the final joint between the two halves came out even, which indicates that there was little settlement. It was thought that the use of the centering the first time would tend to compress the timber and bring the joints up so tight that there would be no give at all the second time, and that proved to be about the case.

The same procedure was followed on all of the arches and at no time was there any hint of grief in re-using the centering as outlined above.

In anticipation of winter construction, it was decided to store a sufficient amount of the aggregate to last during the winter months, when the local gravel plants suspend operations. The plant mix aggregate was bought from the Carmichael Gravel Co. and the Neal Gravel Co., located 2 and 3 mi., respectively, south of Attica on the Covington-Attica branch of the Wabash R. R. The material was shipped to Attica at the rate of six cars per day, and spotted on the rail facility nearest to the bridge site at a distance of 1½ blocks from the east end of the existing and proposed structures, the point where it was decided to build the stock pile. The material was hauled to the stock pile in bottom-dump wagons. By means of a snatch team and a careful sloping of the approach, the pile was carried to a height of 20 ft. At the time the pits ceased operations on December 21, 1920, about 110 cars of aggregate had been delivered.

Concrete Plant

The concrete mixing plant was arranged to take advantage of the natural conveniences. A 250 cu. yd. capacity bin was built under the approach span of the old structure. Three openings were made in the floor of the north side of the span and were so arranged that the traffic could safely pass over them when they were closed. The doors were made of a ¾-in. iron plate, to which was bolted a plank flooring. These horizontal plates ran over short sections of gas pipe placed on 4-in. centers, and therefore required very little effort to manipulate them.

The material was reloaded from the stock pile into bottom dump wagons by means of an "A-frame" traveler with a 60-ft. boom, equipped with a ¾-yd. clamshell. It was dumped directly from the wagons into the bin through the openings in the floor of the old bridge. The sloping floor of the bin was built with a false bottom, through which steam coils passed, beginning at the top and running longitudinally back and forth to the bottom, where a valve was placed for drainage purposes.

In cold weather, the steam was turned on the evening before concrete was to be poured, and by morning the material was very hot, decreasing in temperature toward the top of the bin away from the coil.

The aggregate passed through a vertical sliding gate into the measuring hopper. Two compartments, each containing the proper amount of cement for the particular class of concrete to be placed, were built above and to the side of the measuring hopper, and by means of vertical sliding doors the contents of either compartment were discharged on the top of the gravel. From the mixer the concrete passed directly into a bucket on an 80-ft. tower, from where it was distributed to different points, as described later.

Method of Transporting and Placing Concrete

The foundations and parts of the shafts of the piers were all poured from the old structure. Trucks, with a hopper built on the frame, were loaded under chute at east end of old structure and transported the concrete where needed, and it was then carried to its permanent position by means of chutes from old structure. Later on, after the south half of extreme east span was completely poured (including arch, spandrel walls and sidewalls), a narrow gauge track was laid directly over the wall. The concrete was then dumped from the tower into a hopper directly over the track, from where it was loaded into side dump cars and hauled with a dinky gasoline locomotive. A temporary track was laid over the arch ahead to be poured and the concrete was deposited by means of chutes. As soon as the span was entirely completed the track was laid as on the first one. In this way the work progressed through the third arch. The last three had in the meantime been poured from the mixing plant on the west side of the river. In a case where the concrete could not be handled with a chute, it was brought to a centrally located hopper and carried into position by means of buggies on a temporary platform built over the arch. The narrow-gauge track was built clear across the bridge as soon as the spandrel walls were complete, and was utilized to transport all of the concrete for the south half of the structure.

Backfilling Over Spans and Building Approaches

After the steel derrick completed its part of the foundation work it was moved to the west near the extreme abutment and started back-filling around the abutment and also west approach taking material from a borrow pit on the upstream side of the new bridge. About 6,000 cu. yds. of material was obtained in this way. This borrow pit had been donated by the local merchants in order to get away from using any part of the old fill for the new one, and thereby at some time or other shutting off the traffic into town from the west.

The additional 6,000 cu. yds. was required to complete the west approach, about 5,200 over the bridge proper and about 700 in the east approach. The contractor decided to use the gravel in the river and permission was given him to do so. He was then asked to fill in over the arches in such a way that the load would be evenly distributed along entire length of bridge.

The mass of the filling was done during the winter months of 1921-1922, and most of the material froze when it was deposited. No ill effects of this were ever noticed, however, due to the fact that this was not all completed until warm weather set in, and that gave the contractor an opportunity to take care of all of the settlement when the frost came out.

On account of the new approach covering part of the old one, it became necessary to shut off traffic for three days while this part of the fill was being completed. Traffic was finally permitted to cross, March 9, 1922. Some little doubt was experienced about the possibility of this clean washed gravel packing, but after two weeks it became evident that the fears were groundless. A test made four weeks later showed that gravel was packed so hard for a depth of 8 in. that it was impervious to water. Part of the success in maintaining traffic was due to the fact that a 4-wheel drive Nash truck was first taken across and made a two-way traffic path, and subsequent vehicles followed these same ruts and gradually packed the roadway.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
Editor

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Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

Vol. LXIII. July 26, 1922 Number 4

TRACTIVE RESISTANCE OF ROADS STUDIED

Initial results secured from an investigation of the tractive resistance of roads indicate that information will be secured of great value to the highway engineer and the user of motor transport. The investigations are being carried on under the auspices of the Advisory Board on Highway Research of the National Research Council with which the Bureau of Public Roads and the Quartermaster Corps, United States Army, are co-operating.

One phase of the investigation shows that there is a great difference in the power required of the engine when a truck is traveling over different types of surfacing, the amount being more than twice as great on some of the lower types when compared with that on higher types. It is also shown that the power required to overcome the road resistance is not proportional to the speed of the vehicle and after a certain speed is reached increases very rapidly.

The investigation when complete will cover tests with various types of motor vehicles with the load, tire, and spring equipment varied on different types of surfacing and at varying speeds. The data will include gasoline consumption, internal engine resistance, wind resistance, and road-surface resistance. When carefully analyzed, it will aid the highway engineer in determining under a given set of conditions what type of surface should be built for a given volume of traffic to result in the least total cost for road and vehicle operation. The same sort of study will be made as to expenditures for grade reduction to reduce operating costs. The truck operator will be given valuable information on the effect of tire and spring equipment, lubrication, size of load and speed of vehicle on fuel consumption which should aid him in producing cheaper transportation.

ROAD OFFICIALS CONSIDER LINKING UP STATES SYTEMS

A meeting of New England state highway officials and engineers of the Bureau of Public Roads on June 20 marks an important point in the development of highways in this country. This is the first meeting ever held between officials empowered to act, for the purpose of laying out a system of highways to serve an area larger than a single state. It is the first of a series of similar meetings which will be held between the federal officials and highway authorities of various groups of states, the object of which will be the solution of the problem for the whole country.

This progressive step, long wished for by all users of the highways, can be attributed to the requirements of federal-aid legislation. It is required that all federal aid be spent on a connected system of highways designed to serve the needs of the whole country. Tentative systems have been submitted by all except eight states, and now the series of meetings is being held to connect and coordinate the proposed state systems.

The Bureau of Public Roads intends to push this work as rapidly as possible, so as to lay before the people the plans for what will be by far the greatest highway system in the world. At present only roads certain to be on the system are being approved for construction with federal aid.

TRUCKS DENIED USE OF HIGHWAYS

The Colorado Public Utilities Commission has rendered a decision denying motor trucks the right to use certain roads because they do not contribute their share towards the construction and maintenance of such roads as contrasted with the railroads which pay much larger taxes and besides construct and maintain their own road beds. The Colorado commission holds that the motor truck owners have no right to turn into profit the money which the taxpayers pay for the construction and maintenance of public highways.

According to the report of the commission, an investigation was made in Eagle and Garfield counties, through which the bus lines sought to operate, and it was found that, although there were 68 motor trucks operating as common carriers, they paid into the state treasury for the use of the highways only $819 per year. During the same period, the Denver and Rio Grande Western Railroad, which these buses parallel, paid $38,023 for roads which they do not use at all and, in addition, other taxes making the total in the two counties $153,896.

The following is the most significant paragraph of the opinion:

"Public convenience and necessity, by which must be understood the convenience and necessity of the people at large as contradistinguished from the convenience and necessity of a very small number of people who seek to derive profit from the farmer's and home-owner's investment in roads, never contemplates that the truck owner should destroy that, to the construction of which he contributed little or nothing, or that he should reap where he has not sown. When the taxing laws of this state are so amended that the truck driver operating over the state highways shall contribute his due proportion to the cost of construction and maintenance of our highways, then, and only then, can this commission regard his use, under proper conditions and restrictions, of a great, tremendously expensive public facility of equal dignity and equal benefit to the people with the moderate use thereof by the ordinary taxpayer."

GOVERNMENT'S SMALL EXPENDITURE FOR ROAD BUILDING

In the aggregate, the sum of $50,000,000 looms up in an imposing manner, even in a great country like this, as an item of expenditure—and this applies more fully to the taxpayer than to the mathematician, but when a comparison of this sum, to be spent for road work throughout the United States by Uncle Sam during the coming fiscal year is made with the total military and naval expenses of $2,772,000,000, it seems pitifully small, especially when it is considered that, however necessary, military and naval expenditure is an economic waste, while money spent for road building pays large dividends on the outlay, year after year. Government budgets cannot be considered well-balanced so long as the cost of military and naval establishments is twenty-five times that of road construction and maintenance.

RADIO TO AID ROAD BUILDERS

Frank Page, State Highway Commissioner of North Carolina, will have installed in his office in Raleigh a radio broadcasting station and receiving stations in each of the nine district offices located at Tarboro, Kinston, Wilmington, Durham, Greensgoro, Charlotte, Elkin, Marion and Asheville. With this equipment the administrative forces of the commission will be able to get in immediate touch with the construction and maintenance engineers throughout the state and thus effect a saving of several hundred dollars per month in telegraph tolls and in stenographers' services. This is quite an innovation in highway work as no other state has used radio for this purpose, and North Carolina will go down in radio history as being the pioneer state to use the wireless telephone in carrying out an extensive road building program. While in Washington a short time ago, Commissioner Page was offered this radio equipment which is a part of the surplus war material that is being allotted to the various states, and realizing the tremendous advantage to which it could be used in the work, he immediately accepted the offer. In this way the equipment will be secured without cost to the state except for the cost of installation. Work of installing the broadcasting and receiving sets will begin within a short time and should be completed by the first or middle of August.

NEW JERSEY COMPLETES BEST SECTION OF LINCOLN HIGHWAY

The new 6-mi. stretch of Linclon Highway between Elizabeth and Rahway in New Jersey has been declared by the Lincoln Highway Association to be the finest existing section of the transcontinental road between New York and San Francisco. It will be surpassed only by the ideal section which is to be constructed in Indiana this year. The new road carries the heaviest traffic of any of the 3,300 mi. between the Hudson River and San Francisco Bay and the specifications reflect the weight and volume of the traffic. The section is 29 ft. wide and 4.5 mi. of it consists of 2-in. asphalt surface on a 9-in. concrete base. The remaining 1.5 mi. is of concrete 11 in. thick. The cost averaged $85,000 per mi.

FEDERAL AID TO ROADS IN PUBLIC-LAND STATES

A statement showing the amount per mi. and the percentage of the total cost that can be paid on federal-aid road work in certain public-land states from $50,000,000 recently authorized for the fiscal year beginning July 1, has been issued by the U. S. Bureau of Public Roads.

Fifty per cent of the cost, not to exceed $16,500 per mi. is the maximum participation in all states except those containing unappropriated public lands in excess of 5 per cent of all lands in the state. For these states the special provision is made that the government may participate to the extent of 50 per cent plus a percentage ratio of the total estimated cost equal to one-half of the percentage which the area of the public land bears to the total area of the state. The maximum federal aid of $16,500 per mi. is increased by a like percentage. This has been done to secure the construction of important trunk line highways through thinly settled regions.

The table is as follows:

State	Percentage Payable by U. S.	Maximum Federal-Aid Payment per mi. of Highway $16,500-Basis
Arizona	61.11	$20,167.20
Cailfornia	59.31	19,575.49
Idaho	58.01	19 144.97
Montana	53.04	17.501.23
Nevada	87.22	28,784.51
New Mexico	61.50	20,297.58
Oregon	61.43	20,175.12
Utah	74.85	24,701.89
Wyoming	64.65	21,335.83

Equipment — Trade — Materials

THE HAUCK ASPHALT SURFACE HEATER

Two sizes of asphalt surface heaters for resurfacing and patching asphalt roads and streets have been placed on the market by the Hauck Manufacturing Company, 136 Tenth St., Brooklyn, N. Y. The smaller size has a hood 24 x 48 in., a 25-gal. fuel tank, 2 burners, a fuel consumption of 2 gal. per burner per hour, and weighs 460 lb. The larger has a hood 48 x 72 in., two 25-gal. fuel tanks, 3 burners, consumes 3 gal. of oil per burner per hour, and weighs 860 lb. The lengths over all are 11 ft. 2 in. and 14 ft. 6 in. respectively.

These heaters are well balanced, so that they can be easily moved about, and are so designed as to be simple to operate. The burners operate with kerosene and are absolutely dependable. Each burner is controlled and operated individually by a valve and can easily be removed for cleaning. The flame enters the hood fully developed and produces uniform heat, and because it does not strike the pavement directly the burning of asphalt and the consequent smoke are practically eliminated.

The machines have proven popular in service, as is indicated by sales in California. The City of Oakland, operating the large size heater with five men in the crew, averaged 710 sq. ft. per day for 11 days on a busy thoroughfare at a cost of 4 ct. per sq. ft. On quiet streets the cost was only 3 ct. per sq. ft. The California Highway Commission has recently ordered eight more heaters in addition to four which are already in service on the roads of that state.

EQUIPMENT LEASE OUT

An equipment lease that constructors are willing to sign as either lessee or lessor has just been issued by the Associated General Contractors of America. Its object is to establish on a basis of common equity those obligations and responsibilities properly involved in renting construction machines, and to provide a simplified rental agreement which will insure absolute fairness to both parties. The form adopted is the result of investigations and criticism of members of the A. G. C. extending over a period of two years.

Both construction and equipment leasing companies have frequently been subjected to expense and annoyance on account of misunderstandings which arise when equipment is rented by verbal or letter agreement or by an unsuitable form of lease, and it is to overcome such difficulties as these, as well as to eliminate drastic and unreasonable provisions, that the new standard form has been adopted.

The standard form is arranged so that all blank spaces for filling in of dates, rental rates and other stipulations are segregated on the front of a single sheet, and those provisions of general application and requiring no filing in for ordinary conditions are segregated on the back. Thus a concise form of letter size convenient for filing is afforded.

Copies may be obtained from the Associated General Contractors of America, 1038 Munsey Building, Washington, D. C., or through the secretaries of associated organizations, at 10 cents each or $5 per hundred.

MINNESOTA CONTRACTOR MAKES FINE RECORD

Aaby & Maturi, Minnesota contractors, report some interesting operating data, taken from their records, on a 14-mi. road known as the Miller Trunk Road, in Minnesota, located north of Duluth and south of Eveleth. The road is 18 ft. wide, 7.5-in. concrete pavement reinforced with four 0.75-in. reinforcing rods laid longitudinally and 0.5-in. rods spaced 18 in. apart laid transversely, the rods being wired at each intersection. The concrete was 1-2-4 mix, 5 bags to the batch. Sand and gravel taken from a gravel pit near the middle of the job was transported to the mixer by means of industrial trains, each car carrying two batch boxes. Two 21-E Smith steam driven, boom and bucket full caterpillar type pavers were used. The mixing time by batchmeter was one minute.

For the first week the average was 771 ft. per working day. The performance record follows:

Wednesday,	May	10,	laid	721	lin.	ft.	in	10	hours.
Thursday,	"	11,	"	735	"	"	"	"	"
Friday,	"	12,	"	902	"	"	"	"	10½ hours.
Saturday,	"	13,	"	640	"	"			
Sunday,	"	13,	"	....					
Monday,	"	14,	"	945	"	"			
Tuesday,	"	16,	"	760	"	"			
Wednesday,	"	17,	"	550	"	"	Rain		
Thursday,	"	18,	"	250	"	"	Rain		
Friday,	"	19,	"	842	"	"			
Saturday,	"	20,	"	600	"	"	Stopped at 3 o'clock.		

TRAFFIC COUNT SHOWS SURPRISING FACTS

A traffic count conducted by the Bureau of Public Roads in cooperation with Tennessee officials on a number of roads in Davidson County, in which Nashville is located, shows surprising facts when compared with a similar count in 1916. During this period automobile registrations have doubled, while the number of motor vehicles on the road is five times as great as in 1916. In 1916 horse-drawn and motor-vehicle traffic were almost equal in volume. In 1921 horse-drawn traffic had decreased only slightly in volume and constituted 16 per cent of the traffic, motor vehicles constituting 84 per cent. Observations in this and other counties lead to the conclusion that volume of traffic may increase in much greater proportion than the number of motor vehicles and will also depend to a large degree on the condition of improvement of the road and on the economic conditions in the adjacent territory.

PAINTING LENGTHENS LIFE OF STEEL HIGHWAY BRIDGES

The life of many steel highway bridges is materially shortened because of infrequent and improper painting, says the Bureau of Public Roads. Each year a considerable amount of money is spent for the replacement of rusted bridge members that would have remained sound if they had been kept painted; and more serious than the waste of money is the danger to the public due to the weakening of some hidden part which may cause the collapse of the whole bridge. Officials of the bureau urge that all steel bridges be inspected at least once each year and repainted at the first sign of rusting. Normally repainting is required at periods of from two to five years, depending on the climate. A suitable paint should be used, and if there is uncertainty about any paint, information should be requested from the state highway department.

It is a mistake to repaint without properly cleaning the metal of all dirt, rust, loose paint, and blisters. Usually the places hardest to reach are the ones that should receive the most attention.

The American Engineering Standards Committee has approved as "American Standard" the specifications for the testing and use of permissible explosives submitted by the U. S. Bureau of Mines.

CONTRACTORS URGED TO STORE RESERVE ROAD BUILDING MATERIALS

A letter has been sent to all the state highway departments by the U. S. Bureau of Public Roads urging them to take steps at once to secure the delivery of as large a supply of road building materials which must be transported by rail as is practicable. Attention is called to the fact that the country would now be experiencing a car shortage if it were not for the coal strike; that upon its termination the demand for coal will unquestionably bring about a shortage of open top cars and that there may be considerable pressure brought to bear to restrict the use of such cars to coal only. The various highway departments in turn have carried this message by circular letters to the road contractors.

NEW FILM SHOWS NATIONAL FOREST ROADS

Roads constructed by the government in our national forests are illustrated in a new film prepared by the U. S. Bureau of Public Roads, which can be secured from the department for use on a specified date, the only cost being that of transportation in both directions. The title of the picture is, "High Roads and Sky Roads."

While the picture was filmed in a region of scenic beauty and is therefore of interest to everyone, the engineer will, perhaps, be most interested in seeing how the difficulties of construction have been met. The work is characterized by solid rock excavation, benching for the roadbed on slopes too steep for fills on the downhill side, tunnels, clearing through dense forests and fallen timber, long stretches of maximum grade, switchbacks and bridges over roaring streams. All this can not, of course, be shown in one reel of film, but there is enough to show many of the difficulties of the work.

The contention of the municipality of Jersey City that the work on the vehicular tunnel between Manhattan and Jersey City under the Hudson River could not proceed without a building permit from the city was overruled by Chancellor Walker on July 13 when he permanently enjoined the city from interfering with the construction.

Director Herrick of the Ohio Highway Department has issued a statement that warns the people of Ohio that, before the end of the summer or at least early fall, they will see signs on the state highway system saying, "No maintenance for lack of funds." The state has 1,000 mi. more road to maintain and repair than it had a year ago and no more money to do it with.

A bulletin of the Minnesota Highway Department gives the average costs of maintenance on the trunk highways of the state; $250 per mi. on graveled sections, $123 on pavement and $181 on unsurfaced mileage. The last figure is considered as about the limit that can be used to advantage on that type.

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TABLE OF CONTENTS

Highway Inspection As An Aid in Handling Contracts. 37
By H. E. Hilts

A Census of Highway Research 39
Report of the Advisory Board on Highway Research of National Research Council

The Fourth International Road Congress 40

The Present State of Research on the Tractive Resistance of Roads 42

Editorials and News Notes 43

Personal Mention 46

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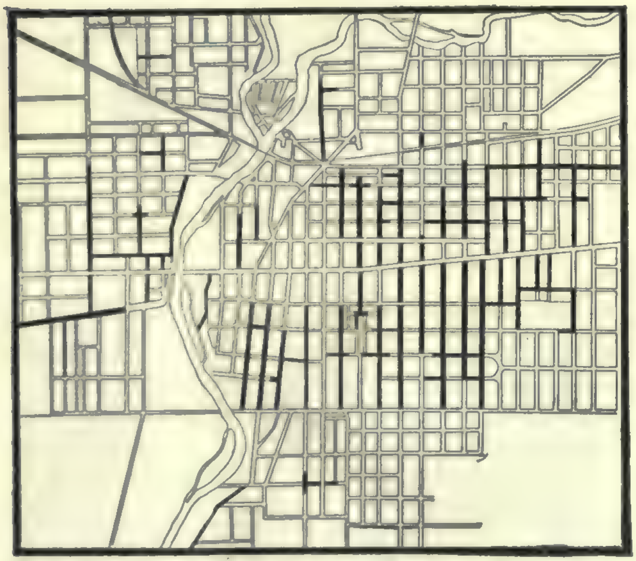

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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Highway Inspection as an Aid in Handling Contracts

By H. C. HILTS

Assistant Engineer, Pennsylvania State Highway Department

It has been found in the Pennsylvania State Highway Department that, in connection with the construction of a large mileage of durable highways, the work of the executive is that of an adjudicator and that the work at headquarters is simplified and systematized by the careful manner in which inspection work is handled on the construction contract. The inspector can many times reach decisions that will lessen the work of both the district office and the main office of a department. The design of highways is subject to standardization and work of this character can be systematized. Plans also can be carefully checked, but inspection depends on the man assigned to it; therefore, all inspectors should be selected with care.

Selecting the Inspectors

The work of a survey corps can also be systematized and checked, but after the work of an inspector has been done, checks may be made, but errors are costly to correct. In Pennsylvania, candidates for inspection work are not selected by civil service, the policy of "hiring and firing" being preferred. It is believed that all inspectors should be interviewed at headquarters before being employed, the candidate, on being employed, is told that he should consider himself a servant of the public, and that as far as emoluments of office are concerned, he must also realize that the satisfaction of building a road that is a credit to the department and to the commonwealth, must serve, in his own mind, as additional recompense. He is told that as far as the department is concerned, he is not merely building route number so and so, but in the future the contract on which he is employed will be known as the road that Inspector "Smith" supervised. In other words, an attempt is made to appeal to the human element and arouse the candidate's ambition so that he will deliver a real job.

The inspection of construction is only a small part of inspection work. Preliminary to the making of surveys for the preparation of plans, the district engineers inspect existing roads, which they know will be improved in after years. In other words, every trip a district engineer makes over an unimproved road permits him to visualize relocations or changes in roads, and in the spring of the year these trips are particularly valuable in the inspection of drainage conditions.

All construction plans are premised on careful studies of drainage, and an endeavor is made to locate both subsurface and surface drainage structures so that they will answer not only the ordinary conditions, but also such extraordinary conditions as developed during the heavy winter of 1919, when roads that had been constructed for years gave signs of distress during the spring thaw. These inspection trips, as they respect drainage, should be summarized by adequate notes which can be interpreted by the men in the office, who are designing the road.

During 1921, Pennsylvania constructed 678 mi. of highway, largely made up of the so-called durable types—sheet asphalt or asphaltic concrete on cement concrete foundations, vitrified brick on cement concrete foundations and one-course reinforced concrete. In expediting this program the material situation was carefully studied during 1919 and 1920. Considerable time was spent during these two years, even during the construction of 253 mi. in 1919 and 414 mi. in 1920, in tabulating material supplies, both local and commercial, by counties and by states adjacent to Penn- the issuance of the survey authorization.

Preliminary Inspection of Roads

After a survey has been made on the line established by the district engineer, a preliminary inspection with the blue prints of the project at hand is made by the district engineer and a representative from headquarters, and if the project is a particularly difficult one, this preliminary inspection is made on foot. At this time, it is decided whether the alignment chosen is the best, and in checking this feature it has been the endeavor to teach the men that

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Abstract of a paper presented at the annual meeting of the American Society of Civil Engineers, 1922.

the laying out of the highway, from the viewpoint of economy, must be developed by a study of distance, of maximum and ruling grades that will set traffic conditions, the elimination of unnecessary rise and fall, and of dangerous curvature. This does not mean that in highway work the refinement used by the railroad engineer has been reached, because in many cases one cannot visualize or even approximately determine which of the previously mentioned features of construction is the most important, whether it is elimination of rise or fall, or curvature, maximum or ruling grades, or a study toward the elimination of distance. The traffic has changed so rapidly in the last ten years that it would appear that even the present-day engineer would have to be the seventh son of a prophet in order to anticipate traffic conditions ten years hence. The checking of judgment by figures in establishing maximum grades, rise and fall, and curvature, which really amounts to the setting of business limits for economical expenditure of funds at this time, must be premised on anticipated traffic which the road will have to bear five, ten or twenty years hence.

Selection of Surfacing Material

Another type of inspection is that of determining the kind of surfacing material which is to be used, and it is felt that, in deciding this question, an inspection on the ground by the district office is most important, so that full data may be secured as to the availability of materials, the nature of the termini of he road, and the present and the anticipated traffic which the road will take.

It has been found that the selection of type should not be based on the first cost alone, but should represent an investment, particularly where bond-issue moneys are concerned, which will, in some measure, be available after the bonds have matured, this investment not only being made up of grading and drainage structures, but also of the surfacing material. The competition between types, where such competition is based on engineering judgment, is healthy and stimulates or results in lower prices, induced by more efficient business methods in the construction of the road.

The preliminary inspection as carried on by the district engineer is made almost simultaneously with an inspection made by the engineer of tests or his representatives, who examine the availability of local construction materials, the matter of inspection many times requiring from 3 to 5 days on a 3 or 4-mi. project. The representatives of the engineer of tests blast out ledges and dig test pits, so that representative specimens may be obtained, and the quantity of materials available may be determined. This work has proven to be of extreme importance. In 1919 there were only about 8 per cent of the contracts on which local material was used. In 1920 some local material was used on 28 per cent of the contracts, and in 1921 there has been an increase in the use of suitable local materials, which has necessarily resulted in a lowering of the first cost of the road.

The mechanical testing of materials, in a well-ordered department, is mostly by systematized routine, and the speaker feels justified in stating that the most important feature of tests is their interpretation. Experience in this work is a fundamental requirement. The writer might illustrate by a comparison of the different kinds of stone found in Pennsylvania, which vary from coarse-grained sandstones to heavy dense trap rock. There is no sand in many parts of the state, and it has been necessary to prepare sand artificially by grinding coarse and fine grained sandstones. Studies were made, which pointed to justification in using artificial sands and in using good sands in combination with relatively poor aggregates, these results having been reached only after the construction of a test road in which various types of materials were used in combination. Test specimens were studied during the construction of the road and compared with specimens taken from the road after it had been in service for a peroid of six months.

The speaker has dealt with inspections made preliminary to surveys and during the preparation of plans. All these inspections have one objective, that is, to have the plans as nearly perfect and practical as possible, and to submit them to the contractor so that he may have full information regarding the roadway under consideration. Each contractor is given, on his proposal form, the estimated quantities as nearly as they can be determined, and on a supplementary sheet he is furnished with the local materials which might be used in the construction work, and their location, with the provision, however, that no guaranty is given as to the continuation of quantity or quality of materials as sampled. It is found that the engineers of the department have used judgment in the preparation of all this material, but it is also suggested and recommended that the contractor, before basing his bids on local materials, should analyze the location on the ground and examine the test pits and the ledges.

The final field inspection also furnishes information on which to base the time limit on the contract. A 5-mi. contract has been built by an efficient contracting organization, in as short a time as 70 days; another contractor not as efficient might have required 3 years in building the same project. It is endeavored, as far as possible by inspection in the field, to work out a conservative time limit for every contract.

Inspection of Awarded Contracts

Only the engineering phase of contract work has been considered in all the inspection details mentioned. Another phase, however, is the inspection of the business of awarding contracts. This has been accomplished in Pennsylvania by calling to Harrisburg for interview each contractor who has been a low bidder. At this interview the assistant commissioner of the department discusses with him the matter of equipment which he contemplates using on the work, this discussion being premised on a list of the major items of equipment which has been carefully prepared by the engineers of the department. This list is prepared on the basis of the minimum amount that should be used in completing the work within the contract time, and it is thoroughly understood, by a gentleman's agreement, that the equipment finally decided on at the conference will be used on the work. Furthermore, the contractor advises whether he owns the equipment, is going to buy new equipment, or is going to rent it. Careful attention is given, in the discussion, to the method of handling the work and as to the contractor's qualifications, based on previous experience in handling men, and as far as the labor situation is concerned, local or imported labor is discussed, and the establishment of commissaries is considered.

It has been difficult at times, during the past three years, to have materials delivered in sufficient quantities and with sufficient regularity to handle the construction work economically. Therefore, the assistant commissioner requires the contractors, during the discussion, to outline a fairly definite program, as to where they expect to purchase materials, so that the department in turn from its previous experience can determine whether materials will be forthcoming, so that the contractor will experience minimum delays. It has been found that this procedure is warranted, inasmuch as it may result in speeding up the work and in reducing the hazard of having to complete one season's contract during the following season, thus causing serious financial loss to the contractor as well as to the state, inasmuch as the new road will not be completed over the winter and spring months.

In order that contract work may be handled promptly and efficiently, every contractor must have financial resources and, in the interview with the assistant commissioner, he must furnish evidence that he is financially able to handle the work, not from a surety point of view, but rather from the point of view of ready cash or stocks or bonds that he can use to raise money, or lastly, from the presentation of letters from banking concerns which express confidence in his ability and their willingness to finace him in an amount equal to at least 20 per cent of the cost of the work. Following the usual practice, the contractor also furnishes a surety bond from an approved surety company in the amount of 50 per cent of the contract cost. The interview with the assistant commissioner is not at all one-sided, inasmuch as he endeavors to impress on the contractors the thought that 100 per cent work is being looked for, and that plans and specifications are prepared to be followed, and, further, that, in order to obtain a 100 per cent job, the department and the contractor must give each other 100 per cent co-operation.

Inspection of Materials

The inspection of materials is made at the source of supply, in order to protect the material man and the contractor, but this inspection is only preliminary. Inspection is also made at the delivery point of the contract, but this can be considered only as preliminary, the final inspection of materials being as they go into the work. It is endeavored to foster high ideals in the minds of the men by proper instructions in readable, illustrated form. The men have been instructed at headquarters and at district office schools, and three of the universities in Pennsylvania have established short courses in which particular emphasis has been given to the tenets of contract law and specifications.

Questions often have been raised as to the cost of making surveys, preparing plans, and inspecting contract work, and there is a lack of data in engineering literature on costs of this nature. Take about twenty-five contracts, which were available and on which tabulated costs have been completed; these jobs include those which have been finished rapidly and on which the plans were prepared quickly, as well as those which were studied for two or three years, and on which the contractor made slow progress, due to weather conditions, the non-delivery of materials, etc. It is found that the cost of these twenty-five contracts has averaged $524 per mi. for field and construction surveys; $175 per mi. for the preparation of plans, and $891 per mi. for inspection work; the total cost expressed in percentage of the contract price being 2.96. The cost of inspection and tests of materials has averaged about one-fourth of 1 per cent of the contract price of the road. In other words, the engienering costs have averaged less than 3¼ per cent of the contract price, and the speaker submits that this is cheap insurance to the taxpayers of the commonwealth, and at the same time furnishes the department definite assurance that it has done its part in working out an efficient and economical method of handling contract work.

A CENSUS OF HIGHWAY RESEARCH

Report of the Advisory Board on Highway Research of the National Research Council

From March 1, 1922, to this date, requests for information have been sent out by the Advisory Board to all the colleges and universities considered as possibly conducting highway research, and to the state highway commissions and other official highway departments. A partially complete list of municipalities, state geologists and industrial laboratories was also used. No attempt was made to obtain a census of research in the motor vehicle field, this being a project of Dr. H. C. Dickinson of the Society of Automotive Engineers.

On June 28 a tabulation was made of answers so far received by the Advisory Board from the original questionnaire and a follow-up letter. Three tables were made, (1) the personnel report; (2) the organization report; and (3) the project report; showing the returns from all the questionnaires sent out. The personnel report includes all individuals circularized to the number of 595. For example, in one college several professors might be conducting research, and each was sent a questionnaire. The organization report shows the number of organizations which received questionnaires to the number of 380. The project report includes the analysis of the researches as to field of application. The data includes a description of the project, methods of attack and names of research workers. The number of replies received will be increased by a second follow-up letter. About half of the individuals replying are conducting research. Of the 131 colleges and universities addressed, 65 per cent replied, and of these 50.5 per cent are conducting research useful in the highway field. Of the 51 official highway organizations addressed, 82 per cent replied, and 78.7 per cent of these are conducting research.

(*Concluded on Page 45*)

The Fourth International Road Congress

The Permanent International Association of Road Congresses Will Hold Fourth Congress in Seville, Spain, Early in May, 1923

A certain indication that after eight years of war and upheaval the world is beginning to return to a normal state is contained in the announcement that the International Road Congress, which ceased operations in 1914 because of the European conflict, is to resume its deliberations early next May at Seville, Spain. The program of what promises to be the greatest and most important conference on highway improvement ever held appears on the following page.

Thousands of delegates representing national and state governments and good roads associations in the United States, Belgium, Canada, Australia, New Zealand, China, Japan, France, Great Britain, Italy, Holland, Sweden, Denmark, Switzerland, Argentina, Czecho-Slovakia, Spain, Portugal, Norway, Germany, Jugo-Slavia, Poland, Austria, Cuba, Chili, Brazil and many other countries, will participate in the Congress and exchange views and experiences for mutual benefit. English, French and Spanish have been adopted as the official languages.

Activities of the Association

The object of the Permanent International Association of Road Congresses is to promote the record progress in the improvement of highways and the efficient development of highway transport throughout the world. The work of the association consists in organizing and conducting international road congresses, publishing the proceedings of its congresses and other documents, and collecting information relative to highway improvement and highway transport. A bulletin of the association is issued four times each year. The bulletin contains complete minutes of the meetings of the Permanent International Commission and the Permanent Council, announcements by the Executive Bureau, and progress reports on highway engineering and highway transport practice throughout the world. Each member, who resides in the United States, receives copies of the English editions of all proceedings, bulletins and other literature published by the association.

The membership of the association consists of representatives of governments and corporations, and individual members. The business affairs of the association are managed by the Permanent International Commission, which is composed of members representing the various governments having membership in the association. Each government has the right to one representative for each 1,000 francs of its total annual subsidy, provided that the number of representatives from any one government does not exceed fifteen. Unfortunately, the United States is the only world power which has not been affiliated with the association.

The First International Road Congress was held in Paris in 1908. At this congress the Permanent International Association of Road Congresses was formed, with headquarters in Paris. The Second Congress was held in Brussels in 1910. Following the Second Congress the Permanent International Commission adopted a resolution to the effect that an international congress should be held every three years. The world war, of course, interfered with this program after 1913.

The Third International Road Congress was held in London in 1913 and was attended by 3,793 members, of which 139 were from the United States. Fifty-two nations were represented at the congress, 44 governments having official representatives. The business sessions of the congress occupied about one week and were devoted to a thorough discussion of 149 reports pertaining to the 19 topics on the program of the congress. During the final business session progressive conclusions relative to every main topic were adopted by the congress.

Reporters for the United States

The following is a complete list of the United States reporters appointed by the executive committee of the association to report on the seven topics on the program of the congress:

Surfacing of Roads with Concrete.—Duff A. Abrams, Professor in charge, Structural Materials Research Laboratory, Lewis Institute, Chicago; E. C. Blosser, State Highway Engineer of Ohio, Columbus; H. Eltinge Breed, Consulting Engineer, New York City; Roy W. Crum, Engineer of Materials and Tests, Iowa Highway Commission, Ames; A. W. Dean, Chief Engineer, Division of Highways, Massachusetts Department of Public Works, Boston; C. R. Ege, Manager, Highways Bureau, Portland Cement Association, Chicago; H. J. Kuelling, Construction Engineer, Wisconsin Highway Commission, Madison; H. S. Mattimore, Engineer of Tests, Pennsylvania State Highway Department, Harrisburg; Clifford Older, Chief Highway Engineer, Illinois Department of Public Works, Springfield, and B. H. Wait, District Engineer, Portland Cement Association, New York City.

Use of Bitumen and Asphalt for Surfacing.—Julius Adler, Deputy Chief, Bureau of Highways of Philadelphia; Lieut. Col. Walter Wilson Crosby, Highway Engineer, National Park Service, Coronado, Cal.; G. C. Dillman, Deputy State Highway Commissioner of Michigan, Lansing; George P. Hemstreet, Vice-President, Hastings Pavement Company, Hastings-on-Hudson, N. Y.; Prevost Hubbard, Chemical Engineer, the Asphalt Association, New York City; William H. Kershaw, Manager, Asphalt Sales Department, The Texas Company, New York City; Leroy M. Law, Chief Chemist, New Orleans Refining Co., Inc., New Orleans, La.; Irving W. Patterson, Chief Engineer, Rhode Island State Board of Public Roads, Providence; Clarence A. Proctor, Superintendent of Asphalt Construcsion, Boston; Francis P. Smith, Dow and Smith, Consulting Engineering, Massachusetts Metropolitan District Commission, Boston; Francis P. Smith, Dow and Swith, Consulting Paving Engineers, New York City; W. Leroy Ulrich, Superintendent of Repairs, Connecticut State Highway Department, Hartford, and George C. Warren, President, Warren Brothers Company, Boston, Mass.

Laying Tramway Rails on the Various Kinds of Road Surfaces.—S. Clay Baker, Engineer, Maintenance of Way, East St. Louis and Suburban Railway, East St. Louis, Ill.; C. B. Breed, Professor of Railway and Highway Engineering, Massachusetts Institute of Technology, Cambridge; Col. R. Keith Compton, Chairman and Consulting Engineer, Paving Commission, Baltimore, Md.; Clarence E. De Drowne, Division Engineer, The Lane Construction Corporation, Longmeadow, Mass.; Halbert P. Gillette, Editor-in-Chief, Engineering and Contracting, Chicago; A. H. Hinkle, Chief Engineer of Maintenance, Indiana State Highway Commission, Indianapolis; A. B. McDaniel, Education and Engineering Specialist, U. S. War Department, Washington, D. C.; Frank F. Rogers, State Highway Commissioner of Michigan, Lansing; Paul D. Sargent, Chief Engineer, Maine State Highway Commission, Augusta; C. M. Upham, State Highway Engineer of North Carolina, Raleigh.

Program of the Fourth International Road Congress, May 1923

FIRST SECTION—

FIRST QUESTION.—*Surfacing of Roads with Concrete.*

Materials, plant used.—Proportions.—Ordinary concrete and reinforced concrete.—Formation of carriageways.—Expansion joints.—Advantages and disadvancantages.—Results obtained.

SECOND QUESTION.—*Use of Bitumen and Asphalt for Surfacing.*

(The use of tar and its derivatives is not comprised in this subject.) The various methods at present in use (two-coat work, one-coat work, carpeting).—Bituminous and asphaltic concretes and mixtures.—Materials and plant.—Specifications and proportions.—Practical tests on site of bituminous and asphaltic materials.—Results obtained.

The various methods at present in use (two-coat work, one-coat work, carpeting).—Bituminous and asphaltic concretes and mixtures.—Materials and plant.—Specifications and proportions.—Practical tests on site of bituminous and asphaltic materials.—Results obtained.

THIRD QUESTION.—*Laying Tramway Rails on the Various Kinds of Road Surface.*

Methods of laying.—Advantages and disadvantages of the various types of road.—Connection between the rail and the surface.—Means for attenuating noise and vibration.

COMMUNICATION.—*Progress Made in Modern Mechanical Appliances Used in the Construction and Maintenance of Roads*: Further improvements and new machinery introduced since the last Congress (London, 1913).

SECOND SECTION—

FOURTH QUESTION.—*The Development of Motor Transport.*

Its influence on economic life.—Net costs of transport.—Desiderata for improvement in the design and construction of roads in order to meet such development.

FIFTH QUESTION—*General Traffic Regulations.*

Dimensions of vehicles (horse-drawn and mechanically propelled vehicles, cycles).—Weights and speeds.—Width of tires.—Lighting.—Brakes.—Drivers' Licenses.—Plates.—Pedestrians.—Animals.—Passing and overtaking.

SIXTH QUESTION—*The Problem of Traffic on Congested Roads and Streets of Towns.*

Solution for consideration.—Design and control of crossroads.—Approaches to large towns.—Urban traffic, single-way and gyratory.—Separation of slow and fast traffic.—Relief roads, signals, police, regulations, etc.

The Development of Motor Transport.—Austin F. BeLeuw, Engineer, Kelker, De Leuw and Company, Chicago; W. W. Horner, Vice-President, American Society of Municipal Improvements and Chief Engineer of Sewers and Paving, St. Louis; Hector James Hughes, Professor of Civil Engineering and Dean of the Engineering School, Harvard University; Henry Maetzel, Assistant Engineer, The Columbus Railway Power and Light Company, Columbus, Ohio; George H. Norton, City Engineer, Buffalo, N. Y.; Clarence D. Pollock, Consulting Civil Engineer, New York City; Robert Ridgeway, Chief Engineer, Transit Commission of the State of New York; George W. Tillson, Consulting Highway Engineer, La Grange, Ill.

Progress Made in Modern Mechanical Appliances Used in the Construction and Maintenance of Roads.—T. R. Agg. Professor of Highway Engineering, Iowa State College, Ames; George P. Coleman, State Highway Commissioner of Virginia, Williamsburg; A. W. Dow, Dow & Smith, Consulting Paving Engineers, New York City; Henry B. Drowne, Division Engineer, The Lane Construction Corporation, Longmeadow, Mass.; Halbert P. Gillette, Editor-in-Chief, Engineering and Contracting, Chicago; A. H. Hinkle, Chief Engineer of Maintenance, Indiana State Highway Commission, Indianapolis; A. B. McDaniel, Education and Engineering Specialist, U. S. War Department, Washington, D. C.; Frank F. Rogers, State Highway Commissioner of Michigan, Lansing; Paul D. Sargent, Chief Engineer, Maine State Highway Commission, Augusta; C. M. Upham, State Highway Engineer of North Carolina, Raleigh.

The Present State of Research on the Tractive Resistance of Roads

The present state of research on tractive resistance of roads was considered by prominent research specialists at a conference called in Washington by the Advisory Board on Highway Research of the National Research Council on July 14 and 15. The relation of the highway to the automotive engineer and the research planned in this field for the near future also came up for discussion.

Reports on researches now actively under way were made by Prof. T. R. Agg, Dr. H. C. Dickinson, A. T. Goldbeck, Major Mark L. Ireland, W. S. James, Dean A. N. Johnson, Prof. W. E. Lay and Prof. E. H. Lockwood. A committee, consisting of Prof C. A. Adams, T. R. Agg, Dr H. C. Dickinson, A. T. Goldbeck, Major Ireland, W. S. James, A. N. Johnson, W. E. Lay, E. H. Lockwood and Prof C. J. Tilden, was appointed to draw up a statement of principles. Dr. W. K. Hatt, Director of the Advisory Board on Highway Research, presided at the conference, and C. R. Ege, H. S. Fairbank, D. C. Fonner and Pyke Johnson were also in attendance.

The report of the committee as adopted is as follows:

Definitions

Rolling Resistance is the resistance to translation arising from the interaction of road and vehicle, but excluding resistances in the engine and transmission system.

As ordinarily measured this includes wheel-bearing resistance, which in case of well-conditioned cars should not exceed 5 lbs. per ton. Rolling resistance by the definition also includes the resistance in the framework and spring suspension system of the vehicle arising from the road. Rolling resistance as measured contains various degrees of impact effects and road displacement effects depending upon the condition of the road and design of the vehicle. Resistance due to horizontal curvature of road should be measured in the experiments.

It is the purpose of tests of rolling resistance to determine the force at the rear axle (or tire periphery) necessary to move the vehicle, as conditioned by road surface, type of road, tire equipment, class and weight of vehicle, etc.

Air Resistance, resistance arising from relative velocity of air and vehicle.

Ordinarily this resistance is included in tested resistance, and should be subtracted to obtain rolling resistance. Investigations are needed to determine the law and coefficient of this resistance for various vehicles.

Rolling and air resistances are those resistances determined when a vehicle is towed with the power transmission mechanism disconnected at the rear wheel. However, the difference between a self-operated and a towed vhicle in respect to tire losses and slipping may make some difference in results, especially at high speeds.

Having the rolling and air resistance, it becomes the function of the automotive engineer to design an efficient vehicle to furnish power for economical transportation over various alignments.

Transmission System Resistance is the force required at rear axle, or tire periphery, to overcome all internal resistance from the clutch to the rear axle. The transmission system resistance depends upon the gear ratio in mesh and the power transmitted, as well as upon other conditions, such as speed, temperature of lubricant, etc. These losses are best determined in the laboratory.

Engine Resistance is the force required at the rear axle or tire periphery to overcome the resistance of engine, including cooling system, fan and accessories. Engine resistance depends upon the operation of the engine as regards throttle opening, speed, temperature and mechanical condition of the engine. These resistances are best determined in the laboratory.

Equipment and Instruments: Rolling and air resistance should be measured for basic types of motor vehicles and tractors. For purposes of comparison of economy of types of roads, expressed in gas consumption, time of translation, and other costs of maintenance of vehicle and road, the rolling resistance should be measured to an accuracy of within 5 per cent. The present state of the art indicates that at low speeds up to 10 mi. per hour, a traction dynamometer of the liquid pressure type, or a space-time recorder, is considered best fitted. At higher speeds, a space-time recorder or a U-tube accelerometer is most satisfactory. New instruments should be investigated, especially the torsion dynamometer.

Tests should be made of adhesion of tires on road surfaces under running conditions to determine safety against skidding under various conditions of brake and tire equipment and road. The use of an accelerometer with locking of brakes is recommended.

Relation of Automotive Engineer to Highway Engineer

The automotive engineer needs data of rolling and air resistance rather than data of gasoline consumption from road tests, since the latter depend upon individual characteristics of vehicle used, carburetor, habits of driver, etc. Having the power factors, the automotive engineer will design the plant to furnish the power required.

From the standpoint of the highway engineer, a problem like the following is set:

A reduction of grade of 4 ft. will reduce energy required an amount of 8,000 ft.-lb What will this be worth in saving of gasoline and other operating expense for traffic considered? Will the solution be for cars as at present built, or for cars using these roads 15 years from now? The mutual relation of highway and vehicle is expressed in the effect of low grades on changes in engine design and power requirements of car. Inasmuch as the large expense of highway transportation is in expense of operation of transportation rather than in fixed charges and maintenance of road, the investigation of costs of operation of traffic is particularly needed.

It is estimated that a 5 per cent grade on a hard surfaced

(*Concluded on Page 46*)

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
Editor

461 EIGHTH AVENUE
NEW YORK, N. Y.

Cable Address: Gudrodes, New York

Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

Volume LXIII August 2, 1922 Number 5

MISSOURI OPINION ON TIME LIMIT DATE

L. Newton Wylder, legal adviser to the Missouri State Highway Commission, has recently rendered an opinion of importance to contractors in that State, and of general interest because of the points involved, concerning the insertion in contracts of the date "December 31, 1922," as the time limit for completion of work embraced by the contracts. Mr. Wylder says:

"Concerning the question raised with regard to Section 2, of the Centennial Road Law, effective August 4, 1921, upon the question as to whether this section requires the completion of work under these and similar contracts approved under the provisions of the Morgan-McCullough Law, by December 31, 1922, our opinion is that if any effect is to be given to the last clause of said Section 2. which provides:—

> "'Provided, however. that all road projects which shall have been approved under the provision of said sections, either by the State Highway Commission, shall be completed in accordance with said sections.'

"We would hold that such projects as were validly and regularly approved under the provisions of the Morgan-McCullough law could be completed after December 31, 1922. * * * There is no doubt but what the Legislature intended that all the counties in the State should be on an equal basis so far as the Morgan-McCullough law was concerned, and the projects thereunder, and the various counties should receive a fair and equable apportionment of the Federal aid funds, and the Federal aid projects to which they are entitled should be carried out even though they ran over into the yar 1923. * * * Following these rules of construction, we believe it is clear that contracts can be let under the Morgan-McCullough law which shall not be fulfilled in 1922. However, I should say that it must not appear in the contract that it will not be completed by December 31, 1922."

GASOLINE TAX URGED TO AID ROAD BUILDING

"Forty million dollars annually can be raised for road building and maintenance by a tax of 1 cent a gallon on gasoline." This statement was made recently by Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads in urging a readjustment of sources of revenue so that a larger proportion would be paid by the road user and a lesser percentage from state or local taxes.

"This method of raising funds," declared Mr. MacDonald, "is rapidly growing in favor and has been adopted in Arizona, Arkansas, Colorado, Connecticut, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Montana, New Mexico, North Carolina, Oregon, Pennsylvania, South Carolina, South Dakota, and Washington. Of these states, only Oregon, New Mexico, Colorado, and Kentucky had such a tax prior to January 1, 1921. The tax in Maryland, Mississippi, and South Carolina has been adopted during the present year and several other states are considerig such a tax."

INVITES COMMENTS ON STATE HIGHWAYS

The Minnesota State Highway Commission has recently sent out to hotels and garages throughout the state self-addressed mailing cards on which suggestions may be made of ways in which the highway-using public may better be served by changes calling for little expenditure. Commissioner Babcock has said that constructive criticism from any responsible person will be welcomed at the highway department offices. If a highway employee is doing good work or bad; if someone is escaping the tax on his car; if the official marking at some highway turn could be made plainer; the department wants to know about it. The post card will carry the suggestion and, if the response is wide-spread, many small improvements may be added to the service rendered by the state highways.

LOWER RATES HELP PAVING BRICK

It is stated by an authority in the paving brick field that as a result of reduction in freight rates on this product the cost of placing brick on the job has been reduced approximately 19 percent in the territory covered by the Indiana Paving Brick Association. Robert H. McKinley, secretary of that association, says this reduction is given as the principal reason for the enormous increase in volume of paving brick business. The association represents nineteen companies in Indiana and Ohio, with a few in Illiois. Mr. McKinley is reported as stating that the Indiana brickmakers did more business during the first half of 1922 than they did during all of 1921.

Indiana is well supplied with road building materials, and most of those used are obtained within her borders. Last year the production of road and commercial gravel exceeded 2,500,000 tons, and it is expected that the tonnage will be much larger this year. In addition, the State produces millions of tons of crushed stone, of which the 1922-23 road programme will call for thousands of tons. The first of the secondary road systems of the State will be started shortly, and 84 miles of road will be built this fall. The 1923 programme will probably call for a considerable greater mileage.

CHEAP FLORIDA ROAD BUILDING

Due to the presence of an ample supply of clay along the line of construction, the new short cut road from Clermont to the Groveland-Auburndale road will be built at a cost of less than $5,000 a mile, this figure including every detail of construction, according to a report from Tavares, Fla. This road is about ten and a third miles long, beginning at Clermont, skirting Lake Minnehaha for three miles, and then crossing the Palatkawaha river, after which it winds between many lakes for another seven miles.

HIGHWAY ENGINEERING AT PENN STATE

Many courses in highway engineering are to be given during the coming school year at the Pennsylvania State College, State College, Pa., according to a statement made from the School of Engineering of that institution. Under the Department of Civil Engineering, course will be conducted in the location, construction, and maintenance of country roads and city and streets and pavements, the chemical and physical examination of materials used in road construction including laboratory tests, land drainage, water supply, town planning, pavement design and similar subjects. The school of engineering, with more than 1,000 students, is now the largest at Penn State.

ENGLISH STREET PAVED WITH RUBBER

Due to heavy overproduction of rubber during the past few years, the industry is staggering under a large surplus which, according to predictions made in the trade, will take a long time to dispose of and while this situation exists, rubber producers and others interested in the industry are trying to find new channels for consumption and a compay has been formed in England to experiment in the use of rubber as a paving material. This company, The Rubber Roadways, Ltd., has made considerable progress during the past year. The most important experiment has been the paving of a section of Borough High Street in London, a street of heavy traffic, with vulcanized rubber blocks attached to a metal plate. This roadway has been in use for about eighteen months and the company reports favorable results. It is added, however, that "considerable time must necessarily elapse before the advantages of rubber roadways are demonstrated sufficiently to convince the authorities that the heavy initial outlay is justified.

The United States Civil Service Commission announces an open competitive examination for the position of Highway Research Specialist in the U. S. Bureau of Public Roads. The salary ranges from $1,800 to $4,500 a year. Receipt of applications will close September 12.

MANY TOURISTS ON LINCOLN HIGHWAY

According to a report just issued from the national headquarters of the Lincoln Highway Association, the number of tourists carrying camping equipment is increasing rapidly, parties planning to stop mainly at hotels carrying camping equipment with them in order that they make camp now and then when exceptional facilities are offered. It is noted that while in general the tourist can camp along the highway almost anywhere from New York to San Franmisco without interference from the owners of adjoining property, many tourists like to make private camps well away from town or city, the increasing number of free camping grounds established within municipal limits makes a strong appeal to the traveler.

EIGHT MILLION FOR JERSEY ROADS

At the end of the present construction season, it is estimated by the State Highway Commission, more than 300 miles of the new State highway system, which embraces 725 miles, will be completed. This year a total of 145 miles are to be laid down, the cost being borne by the counties through which the system runs, with the agreement that the State is to reimburse the counties for this work during the years 1924 to 1926 inclusive.

The general road construction program to be carried out during the present year, however, contemplates the improvement of at least another 150 miles of road.

ENGINEERING CONGRESS TO MEET

The International Congress of Engineering, the first of its kind in Latin America, will be held under the auspices of the Brazilian Government at Rio Janeiro, September 7 to 30, 1922. The congress will be in connection with the opening of the Brazilian International Exposition and the celebration of the first centennial of Brazilian independence. One section of the congress will be devoted to transportation which will of course include highway transport.

HIGHWAY ENGINEERS AID TAX ENFORCEMENT

Nearly 150 engineers and other field men of the Minnesota State Highway Department are engaged in prosecuting unlicensed automobiles in addition to carrying on their regular duties. During the tax enforcement campaign regular employees of the department have listed more than 1,000 cars and caused more than 700 prosecutions which in the majority of cases resulted in fines.

The term, "Portland Cement," was first used in 1824 when a patent was granted to Joseph Aspdin, a bricklayer of Leeds, England, on a process for burning and grinding "Portland Cement." It seems that the application of this term to the material had arisen from the fact that when the cement hardened its appearance was similar to a well-known building stone which was quarried on the Isle of Portland off the south coast of England and extensively used in building construction.

A CENSUS OF HIGHWAY RESEARCH

(Concluded from Page 39)

The Advisory Board has divided the various projects in highway research into five classes: economics, operation, design of road, construction and materials. From the data so far received, it appears in the project report that the colleges and universities are conducting the greatest number of projects, and the state highway departments next, 206 and 149 projects respectively. As might be expected, the subject of materials is receiving the most attention, partly because of the ease with which such tests are made, and partly because other fields have only recently come to be occupied. Approximately 65 per cent of the projects is devoted to materials; 19 per cent to the design of road; 9 per cent to economics; 5 per cent to construction, and 2 per cent to operation. Several organizations active in highway research have not replied. Distribution was found to be fairly widespread, with the exception of a group of states in the south and in the southwest, which do not appear to be conducting research.

(1) Personnel Report.

	No. of questions sent.	Replies			
		Total.		Research conducted.	
		No.	Pct.	No.	Pct.
Colleges and universities.	274	130	47.5	58	44.6
Industrial laboratories ...	47	18	38.6	11	61.1
Municipalities	115	34	29.5	12	35.3
Official highway depts....	124	65	52.4	41	63.1
State geologists	35	22	63.0	16	72.4
Total	595	269	48.7	138	51.3

(2) Organization Report.

	No. of questions sent.	Replies			
		Total.		Research conducted.	
		No.	Pct.	No.	Pct.
Colleges and universities.	131	85	65.0	43	50.5
Industrial laboratories ...	48	19	39.6	11	58.0
Municipalities	115	34	29.5	12	35.3
Official highway depts....	51	42	82.4	33	78.7
State geologists	35	22	63.0	16	72.9
Total	380	202	52.7	115	57.0

(3) Project Report.

Number of Individual Research Projects in Highway Engineering and Highway Transport.

Colleges and universities.	17	3	47	12	127	206
Industrial	1	1	3	0	19	24
Municipalities	5	1	6	1	18	31
State highway depts.....	13	2	25	8	101	149
State geologists	1	0	3	0	17	20
Total	36	7	84	21	282	430

It is evident that a large amount of highway research is being conducted, and it is now the task of the Director of the Advisory Board to publish and send out to all the organizations a summary of the researches which are recorded at the Research Council, thus putting the workers in touch with each other and stimulating the efforts of others. Cases can be cited in which one state has been saved the delay and cost of an investigation relative to the use of materials, when informed of the completed investigation available from another state.

A bulletin will be issued shortly containing a tabulated statement of the nature of the individual projects, classified in various ways.

UNIVERSITY OF MICHIGAN TO AWARD FELLOWSHIP

Two of the following Fellowships will be awarded not later than September 1st and two not later than November 1, 1922, by the Board of Regents of the University of Michigan.

The Roy D. Chapin Fellowship in Highway Transport, which is offered to provide for the investigation of an approved subject relative to Highway Transport.

The Roy D. Chapin Fellowship in Highway Engineering, which is offered to provide for the investigation of an approved subject relative to hard-surfaced roads and pavements.

Two Detroit-Edison Fellowships in Highway Engineering, which are offered to provide for the investigation of approved subjects relative to moderate cost country roads.

General Conditions: Each Fellowship pays the sum of $250, with an allowance of $50 for expenses. The holders of these Fellowships do not have to pay tuition fees. A Fellow must hold a Bachelor's Degree from a college of recognized standing. He must enroll as a graduate student in highway engineering or highway transport and as a candidate for the degree of Master of Science or Master of Science and Engineering. He must be in residence for one of the following periods: First Semester (October to February); Winter Period (December to March); Second Semester (February to June). An application for a Fellowship must include a concise statement of the candidate's educational training and engineering experience, and three references. Applications and requests for information pertaining to the twenty-five advanced courses in Highway Engineering and Highway Transport offered by the Graduate School should be sent to Professor Arthur H. Blanchard, Engineering Building, University of Michigan, Ann Arbor, Michigan.

SURPLUS ARMY EQUIPMENT FOR ROAD BUILDING

The first shipment of surplus war material used by the American army of occupation in Germany, and now to be distributed among the States for use in road construction, arrived at Brooklyn, N. Y., July 1. The equipment, consisting of 30 trucks, 7 tractors, 4 concrete mixers, and 3 road rollers, will be distributed by the U. S. Bureau of Public Roads in the same way as was several million dollars' worth of material from France and the arsenals and camps in this country. Additional material for roadmaking to be shipped from Germany will consist of several hundred trucks, a number of tractors, and about 2,000,000 lb. of spare parts for trucks.

The Pennsylvania State Highway Department has put down during the 1922 construction season up to and including the week ending July 22 approximately 150 mi. of durable highways.

The east or Camden pier caisson for the Delaware River Bridge, connecting Philadelphia and Camden, was successfully launched July 18 at the yard of the New York Shipbuilding Co. at Camden.

FOURTH INTERNATIONAL ROAD CONGRESS

(*Concluded from Page 41*)

search, National Research Council and Professor of Civil Engineering, Purdue University, Lafayette, Ind.; Theodore R. Kendall, Engineering Editor, The American City, New York City; General T. Coleman du Pont, United States Senator from Delaware, and Chairman Board of National Councilors, National Highways Association, Wilmington, Del.; Henry E. Riggs, Professor of Civil Engineering, University of Michigan, Ann Arbor; Leonard S. Smith, Professor of Highway Engineering, University of Wisconsin, Madison; Tom Snyder, Secretary, National Association of Commercial Haulers, Indianapolis, and Lieut. Col. W. D. Uhler, Chief Engineer, Pennsylvania Highway Department, Harrisburg.

General Traffic Regulations.—David Beecroft, Directing Editor, The Class Journal Company, New York City; Chares J. Bennett, State Highway Commissioner of Connecticut, Hartford; Julian Chase, Executive Editor, The Class Journal Company, New York City; George C. Diehl, President, American Automobile Association and Engineer, Erie County, New York, Buffalo; M. O. Eldridge, Director of Roads, American Automobile Association, Washington, D. C.; William S. Gilbreath, Manager, Detroit Automobile Club, Detroit; R. Hirst, State Highway Engineer of Wisconsin, Madison; J. N. Mackall, Chairman and Chief Engineer, Maryland State Roads Commission, Baltimore; D. Q. McComb, Chief Engineer, Tennessee Department of Highways, Nashville; Henry Meixell, Secretary, Motor Vehicle Conference Committee, New York City; George H. Pride, Presient, Heavy Haulage Co., New York City; Henry G. Shirley, Chairman, Virginia Highway Commission, Richmond; Elmer Thompson, Secretary, Automobile Club of America, New York City; Thomas J. Wasser, State Highway Engineer of New Jersey, Trenton.

The Problem of Traffic on Congested Roads and Streets in Towns.—Henry C. Allen, Consulting Civil Engineer, Syracuse Savings Bank Building, Syracuse, N. Y.; J. Rowland Bibbins, Manager, Department of Transportation and Communication, Chamber of Commerce of the U. S. A., Washington, D. C.; William P. Eno, Traffic Expert, Washington, D. C.; H. J. Fixmer, Civil Engineer in charge of Pavement Design and Construction, Chicago Board of Local Improvements, Chicago; Nelson P. Lewis, Member, Commission on the Port of New York, New York City; R. S. McElwee, Dean, School of Foreign Office, Georgetown University, Washington, D. C.; Frank T. Sheets, Illinois State Superintendent of Highways, State Capitol Bldg., Springfield, Ill.; Herschel C. Smith, Asst. Prof. of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor; Samuel W. Taylor, Editor, The Rider and Driver, New York City; Jas. C. Travilla, Consulting Engineer, St. Louis, Mo., and George A. Walters, Second Deputy Commissioner, Department of Police, Detroit.

The South Dakota State Cement Commission expect to let the contract for the state cement plant at Rapid City some time this fall.

The State Highway Department of Kentucky now requires that each contractor submitting a bid at its lettings shall also submit a statement which will show his financial condition and past record.

The State Highway Commission of New Jersey will soon issue an identification card to all its employees. The purpose of the card is to identify an employee when it becomes necessary for him to hold up traffic over a construction job or to go on private property for the purpose of surveying or staking. The card will bear the signature of the employee and will be carried until the employee leaves the service of the department.

PERSONAL MENTION

C. H. Bliss has been appointed assistant sales manager of the Nash Motors Company to succeed W. W. Smith who has been awarded a direct factory distributing contract at Oklahoma City.

Henry G. Shirley is the new Virginia State Highway Commissioner. He was formerly chief engineer of Maryland.

Joseph Ingle, Jr., was in charge of the Juniata Company's recently completed job at Milford, Del., which consisted of a concrete roadway, two concrete bridges, and a fill of 12,000 cubic yards across Haven Lake.

Dr. Frank A. Waugh, professor of landscape engineering at the Massachusetts Agricultural College, Amherst, Mass., has been appointed recreation engineer in the Forest Service, United States Department of Agriculture. Dr. Waugh, a noted author, and one of the leading landscape architects of this country, will spend the summer formulating plans for the development of public camp grounds and summer home sites in the national forests of Colorado, Wyoming, Utah, Idaho, and other Western States. This study is a part of the established plan of the Forest Service toward providing adequate camp and sanitation facilities for the 5,500,000 persons who yearly seek rest, health, and enjoyment in our national forests.

RESEARCH ON TRACTIVE RESTRICTIONS OF ROADS

(*Concluded from Page 42*)

road is not considered excessive for passenger cars, and 2 per cent or 3 per cent for heavy capacity trucks.

The fuel cost and time required, as affected by type and design of surfaces and grades, is measurable by experimental methods, and the depreciation of the vehicle and other maintenance costs should be evaluated from a study of the statistics of motor vehicles obtained in actual operation.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Vol. LXIII. August 9, 1922 Number 6

TABLE OF CONTENTS

The Use of Paint on Roads to Direct Traffic—I . 47
By James R. McConaghie

Roads and Pavements for Average Conditions . . . 50
By John Stanley Crandall

Editorials and News

- The Cash Value of Good Roads 51
- Changing Traffic and Changing Roads . . . 51
- U. S. Roads Bureau Compiles Highway Costs for 1916-21 51
- Southern States Have Big Road Program . . 51
- Indiana Spends Four Million in Past Year on Roads 52
- Maryland Makes Survey of Traffic on State Roads 52
- Motor Vehicle Statistics for 1921 52
- States Get War Material for Use in Road Building 52

Equipment—Trade—Material 53

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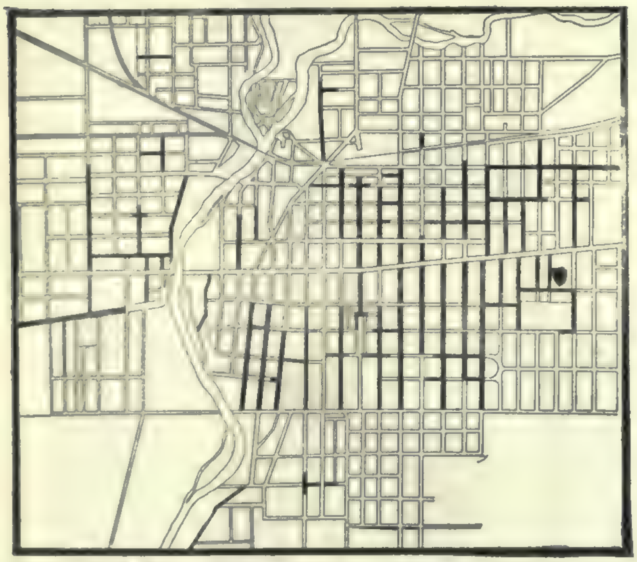
North 15th Street, Richmond, Ind.—Macadam maintained with "Tarvia-B"

Liberty Pike, Richmond, Ind. "Tarvia-B" over waterbound macadam

Chester Pike, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Heavy black lines indicate Tarviated Streets in Richmond, Ind.

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Vol. LXIII. NEW YORK, N. Y., AUGUST 9, 1922 Number 6

The Use of Paint on Roads to Direct Traffic—I

How Painted Lanes and Safety Zones Protect the Pedestrian

By JAMES R. McCONAGHIE

Prior to 1903 in American cities there were no rules for driving known to drivers or police. Vehicles made their way as best they could through the inextricable mass of other vehicles headed in every possible direction. It was early in the year 1903 that the first attempt was made to introduce some sort of traffic regulation in New York City. This attempt was due to Mr. William P. Eno. Through his efforts and the backing of his own purse a good start was made before the year was out. The value of his effort was quickly appreciated and the movement thus started went forward by leaps and bounds. About this time also the automobile was making its initial bow as an element in the traffic question.

Rapid Growth of Traffic

It is with the growth of the automobile that the more important traffic problems came to be a question that attracted the attention of every city. With these ever increasing problems came a like number of solutions, but the extremely rapid growth of the auto industry has created the problems of late much faster than the solutions for these problems have been worked out. The problems created by the automobile are not confined alone to the city. Their rapid increase has created many thousands of miles of improved highways, and the auto problem has helped to create a traffic question that concerns both city and country. In the earlier days traffic could be more easily handled because the element of speed was lacking. But, as we all know, one of the chief characteristics of the automobile is speed. In order to meet this demand then, it is necessary that the means used to control and direct traffic must be as little complicated as possible. Today we have our one-way streets, our numerous traffic officers, our various systems of semaphore and block methods; in fact, we now have a new science that calls for study and training. And there is no question but with the further increase of motors that more and more attention must be given to many of the minor points of traffic control that are little thought of at present.

The First Use of Paint on Roads

Among these there is one important element that could well be used more, and that is the use of painted strips. We find that the use of paint as a means of directing traffic has only of recent years been given attention. The first notice of its use has come within the past five years. The cities of Toronto, Canada and Detroit are among the first places to attempt the use of paint. It came in first as a protection to the pedestrian and has gradually worked its way along until today we find it used both for the guidance and protection of the driver as well as the man on foot.

In the New England section of the country, we find that the Metropolitan Park Commission of Boston was the first to recognize its value. They used it as a means of directing the visitor around the park system. They have been making use of paint for the past three years. The State Highway Commission was the next to make use of painted lines, but they have only started to use it on an extensive scale within the past year and a half. The city of Boston became acquainted with the use of paint as a traffic guide during the police strike in 1919. When the strike came the motor corps took over the traffic direction. This organization was composed for the most part of men with means. These men provided the funds and means by which many lines were painted, providing the pedestrian with a prolongation of the walk line on many of the downtown congested corners. The success of the venture was evident, and if

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Acknowledgement. This article is a report presented in connection with a course in the Harvard School of Landscape Architecture. The writer expresses his indebtedness to the Machusetts Highway Commissions, Captain Hoppe of the Boston Traffic Department, and the Spray Engineering Company of Boston. The illustrations are by courtesy of the Spray Engineering Company and Inspector Harry H. Jackson, Division of Traffic Duty Department of Polce, Detroit, Michigan.

the means were only forthcoming, according to the traffic department of Boston, we should find a very extensive use being made of paint as a traffic director on the streets today.

A Typical Safety Zone in Detroit

In a review of the larger cities of America today we find that all are making use of this means of traffic direction. Some of the western cities, with their wider streets, have gone in for the use of paint much more extensively than has the east. Among these cities perhaps Detroit has gone the farthest. We find there that they have approximately 600 safety zones which are outlined in painted markings and approximately 350 crosswalks. They have also innumerable warning notices painted upon the crosswalks, sidewalks and boulevard roadways. Four hundred such notices were stenciled on streets in 1921. During the year of 1921 they used 3,761 gal. of paint. Other cities are following closely in the footsteps of Detroit. Cleveland and Chicago have both gone into the use of paint quite extensively.

Measure of Success Attained in Use

The reports from these various cities show that every year sees a greater use of paint in various ways to guide traffic. This increase alone speaks of the success of this method of directing traffic. During "Safety Week" in Boston, paint was placed at various intersections, and while there are no actual figures to prove the fact, the Traffic Department is confident that the number of accidents during the week on these particular intersections was greatly reduced. In fact they are so sure of it that, when the various police officers visit the schools on Saturday to give instruction to the pupils regarding certain traffic rules, they make it an important part of their program to see that the pupils are instructed as to what the lines are for. The report from the traffic officers on duty at the important intersections are all very favorable to the use of painted crosswalks and they are continually requesting the department to supply them with more.

Another point to prove the success of such a use of paint is to make timed observations, one at an intersection provided with crosswalks and another at one not so provided. Such an observation made at the corner of Boylston and Tremont Streets, not provided with crosswalks, yielded the following: In five minutes' time 100 autos, 25 trucks, 6 wagons, 3 carts and 4 bicycles went through the intersection. During the same five minutes, 35 jaywalkers risked all sorts of danger and cut diagonally across the street. The majority of the pedestrians followed a route approximately in prolongation of the sidewalks, many of these seemed uncertain as to just where to cross. With this story in mind, a brief study of Central Square, Cambridge, was made. Here we have adequate painted crosswalks. While no numbers were taken, the traffic conditions being somewhat different, it was quite instructive to see how confidently the pedestrian trod the path marked out for him. The jaywalkers were few in comparison. The man driving a car was not in doubt as to where to stop when so signalled by the traffic officers. He would drive up to the line of the crosswalk and stop, where, on the other hand, the man at the other intersection was uncertain as to where he should stop. The orderliness of the one intersection when compared with the other certainly speaks well for the use of the painted strips.

The reports from various police captains are that the people are glad to get the painted areas and that the majority of them obey the silent rules thus layed down. What is thus true of the pedestrian is also true of the average driver. In observing the various lines on the highways we find that the silent order to keep to your own side of the road is in the majority of cases obeyed.

A Painted Crosswalk in Detroit

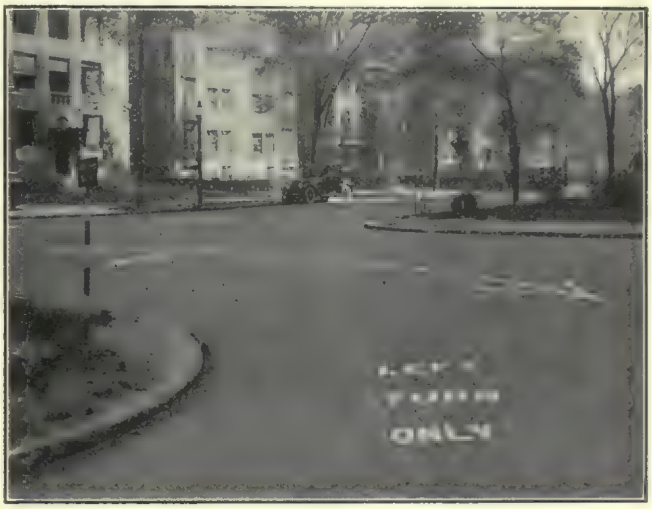
Some of the important traffic problems of today that can be helped to a solution by the use of paint are, first of all, the handling of the pedestrian traffic on downtown streets. Of this we have spoken. Other problems are: the protection of the pedestrian at important car stops; the protection of him on wide street intersections; as an assistant to the enforcing of the law in regard to parking near fire hydrants; the designating of restricted routes; the division of traffic on busy streets; the segregation of fast and slow-moving traffic; to separate several lines of traffic moving the same direction; to separate vehicles at busy intersections into lines for left or right turns and through traffic; to mark out parking or ranking spaces and to divide these spaces so the greatest use may be made of the area. These problems have mostly to do with the city. but many are applicable to the country as well. Those having special reference to the highways are: division of traffic around curves; warning signs of crossroads, entering roads, railroads, schools, bridges, etc.; as guide lines on the more important highways. These are enough to impress us with the idea that there is need of direction, and if paint is the agent that will accomplish this end then its use is certainly to be recommended.

Safeguarding the Pedestrian

The use of paint for the protection and guidance of the pedestrian is mostly confined to the cities. Here we find its greatest use is for the marking out of crosswalks. It has been found that in marking out a prolongation of the sidewalk across the street will curb to a great degree the jaywalking propensities of the average citizen. It has been proven that the average individual gets out into the danger zone simply because he is more or less uncertain as to just where the proper place for crossing is. His mind is many times occupied and he conforms very easily to the marked route.

There are two methods of marking these crosswalks used. In most of the eastern cities, with their narrow streets, the method consists of merely painting strips across the street in prolongation of the existing sidewalks. The width of these strips should never be less than 8 in. This width is enough to give a substantial look to the zone and implies a greater sense of protection. The other method is used on congested intersections of wide streets. The sidewalk along the property line is prolonged across the street, the street line is prolonged only across the center of the street, the line making a turn in front of the street corner. The purpose here is to help relieve the congestion on the street corner by allowing the pedestrian a use of part of the road area. Many of our confirmed jaywalkers are not prone to walk across the center of the intersection, but merely to cut the corners, and where the street is wide enough to premit it is often very helpful to provide route across the corners for those so inclined, and also helps to reduce the congestion on a busy corner. On some extremely congested corners it is often advisable to provide a double crosswalk with a safety zone in the center of the street. An example of this is to be found at the intersection of 16th and K Streets, Washington, D. C. It is advisable to mark the safety area with standards to assist the painted strip.

Another place where protection is needed for the pedestrian is on some of our squares or where several streets converge, forming a large expanse of pavement. A man wishing to go across this area must take a long way round or take his life in his hand and attempt to make his way through many a danger to the other side. It is often found advisable to provide an isle of safety somewhere near the center of this expanse. These zones of safety, or isles of safety, really serve two purposes. They furnish safe stopping places for the pedestrians in crossing the crowded roadway, releaving congestion on the sidewalks and dividing or canalizing traffic, thus assisting in bringing about vehicular order. Zones of safety have been in successful use for at least half a century in Europe, and their number is being constantly increased. They have been adopted quite largely in South America. It is only in the United States that their adoption has been tardy, due to the fact that the people of this country usually have to get all their experience first hand.



"Safety First" for Both Pedestrian and Driver

Permanent zones of safety are usually raised places in the roadway, the height of the sidewalk, though in a great many cases it is just as well to define them by paint limit lines with perhaps some standards to assist in the daytime and some lamps at night. In installing these zones of safety we should determine first just how much roadway width can be spared. Their length should usually be not less than 15 or more than 30 ft. The best form is that of a parallelogram with elliptical; ends. In Paris the ends are round, in London elliptical; elliptical is best from the point of view of the motorist. Until recently zones of safety have been placed nearly in line with the curb. This reduces the turning space of the roadway intersection. It is better to place with one end tanget to an inscribed circle, thus leaving all the turning space possible. However, the exact size, shape and location of these zones will vary according to the intersection and the problems it presents.

Besides zones of safety, which are intended for the use of pedestrians only, there are other restricted zones into which pedestrians should not enter; others into

(*Continued on page* 54)

Roads and Pavements for Average Conditions*

By JOHN STANLEY CRANDALL

(Consulting Engineer, The Barrett Company)

The tax payer is the man who should be most interested in the question of roads and their relation to himself. In a general way he is interested, but not specifically enough for his own good, nor for the good of his pocketbook. Ask the average man who has been motoring all day to tell you what kind or type of roads he has been travelling over, and he will be unable to tell you. He does not know the difference between gravel and macadam, and often he can not tell a dirt road from a macadam. In fact, the average man does not know what macadam really is. If there are some stones in the travelled way, it is a macadam road to him, and that is all he seems to want to know. If it is white and hard, it is concrete. If it is dark, it is tar. If it rides well and is dustless, it is good. If it is rough, it is "rotten." And that is about as far as the average man gets in the road problem.

Limited Knowledge of the Pubilc

The next time you are at your club, bring up the subject of highways and see for yourself how sketchy the information really is that your fellow club members have on the subject. The result will surprise you unless you have tried it before. In a New York club recently, the topic came up in the course of the evening and one member read a clipping from a newspaper in which the statement was made that a certain country highway was about to be rebuilt at a cost of $100.-000 a mile. Immediately, there was a hub-bub, and these safe and sane business men with one accord said that there was no highway in any rural district that was or could be worth that amount of money to the country.

The public does not know exactly what roads should cost, but it is well satisfied that there has been, sometimes, too lavish an expenditure of its taxes for types of roads that are not necessary. The newspapers have reported a wave of resentment against high cost pavements and the wave is apparently sweeping over the continent. So mighty has it become that it has reached the United States Congress in the form of a demand that the government shall not contribute federal aid on any road to an amount exceeding $10,000 a mile. One representative argued for a $4,000 maximum. With the $10,000 maximum it would mean that on a $60,000 road the state would pay $50,000 and the federal government $10,000. Since the state usually expects to spend the same amount as the federal-aid sum, it will be seen that a $20,000 a mile road is the one that must be built with government money.

Some interesting figures were brought to light in the Ohio bids up to March 13. These figures were:

Tar macadam	$19,673.14
Bituminous concrete	30,231.14
Reinforced concrete	33,541.09
Brick	35,667.03
Plain concrete	36,143.56

The types of road that can be built under $20,000 a mile are gravel, macadam and tar macadam. The question that immediately arises is: Can these types successfully carry the traffic of the future on the average routes of this continent? And the answer is that undoubtedly they can.

A good gravel road, well maintained, is one of the pleasantest of all types to ride over, and it will carry a surprisingly large amount of traffic. When the traffic becomes too heavy for economic maintenance by the usual methods, a gravel road may be given a tar surface treatment that will keep it in good condition most of the year. It must not be expected that tar surface treatments are going to make a cheap gravel road the equal of an expensive city pavement. Nor must it be expected that these treatments need be given but once and the road is to be a first class road evermore. It must be realized that the surface treating of a gravel road is a yearly process, and that unless provision is made at the start for treating the road every year faithfully and carefully, it would be better not to treat it at all.

What Is the Traffic Limit?

How much traffic will a tar treated gravel road carry? That is not easy to say, but it is probable that the average country road in the Dominion does not carry as heavy traffic as do the treated gravel roads in Maine, and these carry a summer traffic, of as high as 5,000 pleasure cars a day, with a sprinkling of trucks. Colonel Sohier has stated that in Massachusetts a treated gravel road will carry successfully 3,000 pleasure cars and 75 trucks daily without undue maintenance costs. Beyond these figures he has said that it was necessary to build a higher type of road.

Gravel roads may be built for less than $10,000 a mile, 18 ft. wide, and the initial tar surface treatment should not cost over $600. Successive yearly treatments should be less than that and the total cost of maintenance from fence to fence not over $900 per mile.

Good, honest, 100% macadam pavements are not as often found as one could wish. All too often what is called macadam is nothing but a two or three inch layer of broken stone on an old dirt road. A real macadam is an asset to any locality. It was the macadam roads of France that saved the day by carrying the loads of men, artillery and supplies from the beginning to the end of the war. A good macadam

(*Concluded on page* 54)

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* Abstract of a paper presented at the convention of the Canadian Good Roads Association, June, 1922.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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Editor

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

Volume LXIII August 9, 1922 Number 6

THE CASH VALUE OF GOOD ROADS

The Congressional Commission which has been investigating agricultural problems has issued some illuminating statistics showing the cash value of good roads to the farmer. From farm to shipping point, in 1918, the cost of wagon hauling was approximately 30 cents per ton mile for wheat, 33 cents for corn, and 48 cents for cotton. Over the same route now, but on hard-surfaced roads and by means of motor trucks, the cost is 15 cents per ton mile for wheat and corn, and 18 cents for cotton.

In other words, good roads have resulted in a direct saving of more than 50 per cent to the farmer, as a farmer who hauled 100 tons of wheat and corn over hard roads ten miles to his shipping point by truck last year did so at a saving of approximately $150 compared with his expense in taking the same crop to market with a wagon over dirt roads in 1918.

The man in the city gets his profit in the receipt of fresh farm products, in the more regular and more frequent trips of the farmer and his family, and in the added ease with which city dwellers can find their way into the country for a change of air and scene. Paying such dividends, good roads are a good investment at almost any price.—**Chicago Tribune.**

Good roads are not expensive to motorists—they are an economy. The poor roads are what cost the money.

The man who advocates higher license fees to maintain and improve highways is not an enemy of the automobile owner. He is his best friend.

CHANGING TRAFFIC AND CHANGING ROADS

In the past ten years there has been a very marked change in engineering practice regarding road types. Ten years ago water-bound macadam was regarded as the highest type of road for rural highways. Today it is out of date. As evidence of this the rapid change in types the federal government reports that on federal roads completed in the period 1916-1920 only 2.9 per cent of the total area paved was plain and surface treated macadam. Of the total mileage 3.1 per cent was bituminous macadam; 6.3 per cent bituminous concrete; 19.3 per cent cement concrete and 4.1 per cent brick. The motor vehicle has developed an entirely new type of traffic and new types of roads must be built to carry it.

U. S. ROADS BUREAU COMPILES HIGHWAY COSTS FOR 1916-21

Average costs per square yard of various types of paving for country roads have been compiled by the Bureau of Public Roads from figures covering 68,000,000 sq. yd. of paving constructed with Federal aid in all parts of the United States during the period 1916-1921. The costs per suare yard are as follows: Sand-clay, 18 cts.; gravel, 46 cts.; plain and surface-treated macadam, $2.10; bituminous concrete, $2.50; plain cement concrete, $2.75; reinforced cement concrete, $2.74; and brick, $4.10. These figures cover only the cost of the paving; they do not include the cost of grading.

A total of 28,135 mi. of road have been built with government aid since July 1, 1916 when the congressional act under which the Federal government was authorized to aid the states in road building went into effect. The total estimated cost of these roads have been $496,151,683.43. Of this amount Federal aid comprised $211,135,376.31.

The average cost per mile of road construction during the five-year period runs from $8,115 per mile for graded and drained roads, to $39,540 per mile for concrete, and $49,570 for brick roads. The average cost of all roads, including graded and drained, sand clay, gravel, macadam (waterbound), macadam (bituminous), bituminous concrete, concrete and brick roads, was $17,630. Federal aid was at the average of $7,500 per mile.

SOUTHERN STATES HAVE BIG ROAD PROGRAM

In road building and street paving work the southern states are showing greater activity than at any other time in their history. Contracts reported during the past four months aggregate in value about $40,000,000. Every state in the South is showing tremendous progress, especially in road improvement. Contracts awarded in the last four months include, in value, the following: Alabama, $1,870,000; Arkansas, $842,000; Florida, $4,800,000; Georgia, $780,000; Kentucky, $870,000; Louisiana, $932,000; Maryland, $966,000; Mississippi, $844,000; Missouri, $2,735,000; North Carolina, $7,780,000;

Oklahoma, $1,975,000; South Carolina, $1,104,000; Tennessee, $833,000; Texas, $6,657,000; Virginia, $690,000; West Virginia, $4,523,000.

INDIANA SPENDS FOUR MILLIONS IN PAST YEAR ON ROADS

More than $4,000,000 was spent by Indiana during the year ending September 30, 1921, in maintaining the state roads. This is $3,500,000 more than was spent during the year 1920, according to John Williams, auditor of the commission, who attributes the large increase to the fact that labor and materials were somewhat lower and that a portion of the bills which were contracted by the previous administration of the commission were not paid until this year.

Construction during 1921 amounted to more than $3,439,000 and approximately 81 mi. of road were completed by the state, as compared with about 25 mi. during the previous year.

MARYLAND MAKES SURVEY OF TRAFFIC ON STATE ROADS

Maryland has recently prepared a traffic map showing the results of a survey of the highway usage over a period of several years. The work was done by the State Roads Commission of Maryland and mapped by the University of Maryland in cooperation with the United States Bureau of Public Roads.

The counts which were made one day per month from 7 A. M. to 7 P. M. extended from 1917 to 1920 show that in 1917 there were 18,142 passenger cars and 2,596 trucks.

The per cent. increase in the two classes since that time is as follows:

	Pass. Cars	Trucks
1917-1918	21	77
1918-1919	21	15
1919-1920	31	59
1917-1920	73	222

MOTOR VEHICLE STATISTICS FOR 1921

The detailed figures on motor-vehicle registration in the United States for 1921, which the U. S. Bureau of Public Roads has just issued as a supplement to its preliminary announcement of a few weeks ago, offer an interesting field for analysis by the highway engineer. While the total of 10,465,995 vehicles for 1921 shows an increase of about 1,250,000 over the 1920 figures, the rate of increase has fallen off. The total registration in 1921 was about 13.6 per cent greater than that of the previous year, as compared with a 22 per cent increase for 1920 as against 1919. The same relationtion, however, does not hold for the commercial-vehicle classification, where a 22.7 per cent increase is shown by the year 1921 as compared with 1920 (last year there were recorded 1,033,151 commercial vehicles, including motor trucks, busses, and taxicabs) as against 841,690 in 1920, a gain of 191,461.

STATES GET WAR MATERIALS FOR USE IN ROAD BUILDING

Surplus war material valued at $139,773,986 was delivered to the states for use in road construction up to July 1, reports the U. S. Bureau of Public Roads. The material, which consisted of all sorts of supplies and equipment suitable for road building for which the War Department had no further need, was distributed on the same basis as monetary federal aid. In value of material delivered, Texas and New York lead with nearly $8,000,000 worth of material, and every state with the exception of five of the smaller ones received supplies valued at over $1,000,000. This material has been of great value in road construction, and there is hardly a county in the United States in which some of it has not been used. Probably of greatest value has been the 29,325 motor vehicles distributed consisting of 24,752 trucks and 4,573 automobiles, and in addition a large number of tractors.

The system of distribution has been so arranged that the states requisition only material useful to them. In some cases they fall behind in allotments in order to wait for material particularly desired. Many of the states have shown great ingenuity in conditioning worn equipment, using war material to equip shops in which other war material is made suitable for use.

There is still a large quantity of material in this country for distribution. This will be further increased by material used by the army of occupation in Germany soon to be brought back.

WALKING ON THE HIGHWAY

It is a common experience when driving on highways near large cities, especially on Sundays, to see hundreds of people walking on the paved roadway and every last one of them on the wrong side of the road. That is, with almost negligible exceptions, those who walk on the roadway walk with the traffic instead of against it. This frequently leads to accidents for which the motorist gets all the blame. The wonder is not that some are injured in this way, but that the number is so small.

Whatever may be said of the rights of the pedestrians and of the motorists in such cases, one must marvel at the assurance of the pedestrian that the motorist not only must not, but will not run over him. Many pedestrians do move over, perhaps the majority do, and this leads the motorist to expect the pedestrian to give ground; therefore when an occasional pedestrian does not give ground he runs a grand chance of getting hurt or killed.

In walking on the highway a pedestrian should face traffic and keep to the edge of the roadway, quite as much to insure his safety as to conform to the old rule of the road. Pedestrians have always yielded ground to wheel traffic and this is the sensible as well as the proper thing to do.

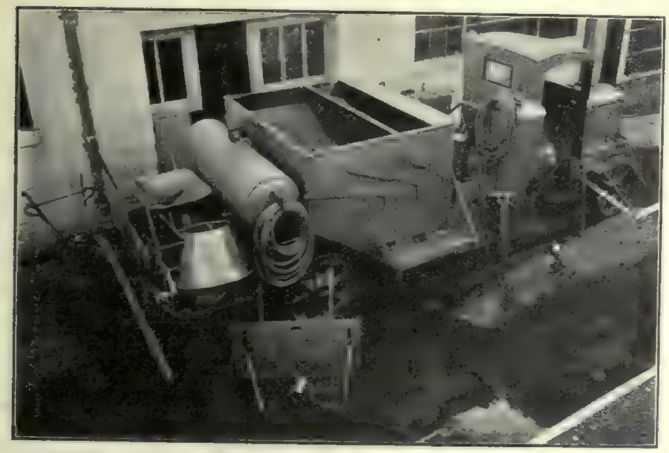
Motor vehicles carried six times as many passengers as the steam railroads in 1921.

Equipment — Trade — Materials

FAGEOL MOTORS COMPANY BUILT UNIQUE MAINTENANCE TRUCKS

A novel and very efficient highway maintenance truck designed and built by the Fageol Motors Company, of Oakland, Cal., has recently been put in service by the board of supervisors of Kern County, Cal. The machine is built on the standard Fageol heavy duty truck chassis, and carries all the materials and equipment necessary for maintenance work on concrete, asphalt, macadam, or dirt roads, for the erection of steel, concrete, or wooden bridges, and for the erection and maintenance of fences or signs.

The highway maintenance truck was first demonstrated at the Pittsburgh test highway last spring, and it was received by the highway engineers with great enthusiasm, on account of the multiplicity of uses to which it can be put, and the time and energy it is capable of saving in repair and maintenance work along the roads. Figures supplied by the Kern County board of supervisors show that in some instances the saving is as high as 55 per cent of the cost under the former system.



The work that this outfit is designed to perform comprises: Repairing ruptures or breaks in reinforced or plain concrete, macadam, or other forms of streets or highways, using pneumatic jack hammers to break up the damaged places, pneumatic air jet to clean out the holes, mixing new cement in power driven concrete mixer, using materials carried in the bins of the truck, and spreading tar or surface oil over new work; using pneumatic post hole digger, setting posts in concrete, or outfit, stretching wire with the side arm, painting or whitewashing wooden fences on grades or dangerous tamping the pneumatic tools, painting with the spray turns with the spray outfit; erecting or repairing steel, concrete, or wooden bridges or culvevrts, hauling materials for same on trailer. Removing old paint or rust from steel work with sand blast outfit, and repainting with spray equipment. Cutting or welding steel work with oxyacetylene outfit; beveling, grading, shouldering up, rolling or draining right of way along highways can be done by use of grading plow attached to side-arm, or to the rear drawbar; cutting asphalt pavement with pneumatic chisels or jackhammer when excating for sewer pipes, underground conduits, etc. Excavations can be properly tamped with pneumatic tools, and surface of street repaired with concrete, surfaced with asphalt, and rolled. Tar tank can be used to keep asphaltum hot.

So successful has the orginal highway maintenance truck proved in operation that the Fageol Motors Company has added the unit to the regular line, and is offering it to cities, counties, street railways, and other institutions interested in cutting down the cost of maintaining highways.

ROTARY PUMP ATTACHMENT FOR 5-TON "CATERPILLAR" TRACTOR

The Holt Manufacturing Company, Peoria, Illinois, are now offering a unique and very practical accessory in the form of a rotary pump, which can be readily attached to the rear of the tractor in exactly the same position as the power pulley attachment. It is driven direct through the countershaft from the motor and is capable of delivering 220 gal. of water per minute under working pressure of 100 lb. per sq. in. At normal speed of 1000 r. p. m. it throws a 1⅛-in. stream 100 ft. in the air and requires but 26 hp., which is only approximately two-thirds of the normal motor capacity of the 5-ton "Caterpillar." There is accordingly a large reserve for overloading, should the pump be called upon for extra heavy duty.

This reserve capacity enables the use of a long hose both for intake and discharge. Where an ordinary length of hose is employed a very broad area can be quickly drenched with a very heavy stream. One special field of usefulness is in patrol work in state forests, in the timber districts, etc. The "Caterpillar," of course, has the power and capacity to travel over all sorts of ground, is able to penetrate to points inaccessible for other machines or vehicles, and is able to travel at an active speed. Where a stream or other water supply is available the "Caterpillar" with pump attachment can render vitally important service in forestry work.

The Novo Engine Company of Lansing, Mich., has secured the order for 10 air compressors for use in the extensive road building program recently undertaken by the West Virginia State Road Department. Five of the compressors are of the large EFH type with four-cylinder engine, 160 ft. displacement, and five are of the AFH type with four-cylinder engine, 75-90 ft. displacement. The large compressors are to be used to break the way ahead of the steam shovels, each compressor to operate two jackhammers. The smaller machines are also for jackhammer work and general road maintenance purposes. Shipment was made to the West Virginia State Road Department at Charleston.

USE OF PAINT ON ROADS TO DIRECT TRAFFIC

(*Continued from page* 48)

which neither pedestrian nor vehicular traffic should enter, except perhaps that confined to rails. These zones are often painted with red strips and include such areas as the danger zone in the center of an intersection or the necessary space around fire hydrants.

Safety Zones for Street Car Passengers

Still another place where the painted zone is used as a protection to the pedestrian is in the marking out of street car stops. The location of these areas vary in different cities. In New York City the cars formerly stopped on the far side of the street, except at fire, hospital and school streets, where they stopped at both sides. In 1904 the "near side" ordinance was passed in New York at the instigation of Mr. Eno, but was soon repealed. In 1914 this ordinance was reenacted and was made to include busses, which, however, have now been excepted. The reasons given for preferring the "near side" stop were safety and reduction in the number of stops. A study was made of the question of "near or far side" stops and the report was that as far as safety is concerned the "far side" seems to be the safer. If cars always stopped at every intersection and never ran over it, the "near side" stop would be safer. For example, one element of danger with the "near side" stop for cars is that they are apt to overrun the intersection, and if fire apparatus or ambulance is coming through the other street it may find in its path a stationary car which must start up before it can get out of the way. Another danger is that a vehicle coming through an intersecting street is uncertain whether the car will stop or not before crossing and takes a chance of crossing in front of it. The "near side" stop for cars is better in one respect only, in that it reduces the number of stops, thereby increasing the number of cars that can be run in crowded hours within a given space of time. The conclusion of this report was that the "far side" stop has the balance of advantage and that compulsory "near side" stops should be discontinued on all streets—fire, hospital and school streets included—but at these latter streets should slow down before crossing. Local conditions and requirements should, however, determine whether the near or far side stop should be selected for each particular location. An essential requirement being that the car stop be located just before reaching or just beyond a sidewalk.

These zones should be outlined with a band of white paint, the strips of at least 4 in. width. The zone should be from 4 to 6 ft. wide and at least the length of the longest car. These dimensions will vary according to location, but in all cases should be ample to provide for all mounting or alighting passengers. It is advisable to have the line marking the end up the street at an angle; this is an aid to the motorist. It is also advisable to have some sort of a standard at this end.

(*To be concluded*)

ROADS FOR AVERAGE CONDITIONS

(*Continued from page* 50)

protected by a tar surface treatment is capable of carrying all but the heaviest traffic. It is the pavement best suited to suburban development, to provincial highways for the most part, and to parks. Where automobile truck traffic is heavy, then the waterbound macadam is not strong enough and a powerful bituminous binder should be used. The road then becomes a tar macadam or tar concrete, the tar acting to prevent internal wear that always results when intense motor truck traffic comes on a waterbound macadam.

The gravel, the macadam, and the bituminous macadam roads are the ones that serve adequately the needs of the average highway and they serve at a minimum of expense. If they are properly maintained, they may be used at any time in their existence as foundations on which to place a more expensive top when traffic demands it.

People become enthusiastic about the work they are engaged in and want the very best that money can buy. Public officials are no different from private individuals in this respect but they are obliged to consider their work from all angles, rather than from the narrow viewpoint of the individualist. They are now hearing the words of protest from the men who helped put them in office and these words take the form of, "More Miles for the Money." That slogan must be given the attention it deserves or the entire road program will be lost. Some of the farmers in the United States are going so far as to demand that all road building be held up until the farmer is back on his feet. They are oblivious of the fact that roads have put them where they are and that good roads will advance them further. But they complain that they have been exploited for the benefit of those who live close to or in towns and cities and that costly pavements in these localities do the distant farmers no good. They want roads that will serve them satisfactorily when they need to use them. They want comfortable roads, safe roads, all the year round, but they do not want roads that will tax them unduly to build.

General Education Necessary

There should be a general movement leading to the enlightenment of the average citizen in the matter of highway costs, so that he may form a sensible idea of the items entering into construction and maintenance. Perhaps the best way to do this would be by use of the moving picture houses throughout the Dominion. If the citizens are not informed they may swing over from the position of wanting highways to that of blocking any further work for years to come.

Highway officials must study the question so that they may provide the maximum good mileage for the minimum expenditure. A survey of what has been done successfully in localities that are not wealthy would be well worth while and the study of these successful low cost types would undoubtedly be a fruitful field for the road official.

GOOD ROADS

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TABLE OF CONTENTS

Economical Methods of Handling Materials . . . 55
By Lt-Col. H. L. Bowlby

The Use of Paint on Roads to Direct Traffic—II. . 56
By Lt.-Col. H. L. Bowlby

Editorials and News

Highway Costs on the Motor Trucks . . . 59
Highways Improve Under Babcock Plan . . 59
Arizona to Spend Half Million for Forest Roads 59
Rubber for Surface Dressing 60
Contract Let for Model American Roads . . 60
Missouri Has Over 4,000 Miles of Hard-Surface Roads 60
Boom in Highway Building Due Mainly to Federal Aid 60

Equipment—Trade—Material

Traffic Control Lighting Equipment . . . 61

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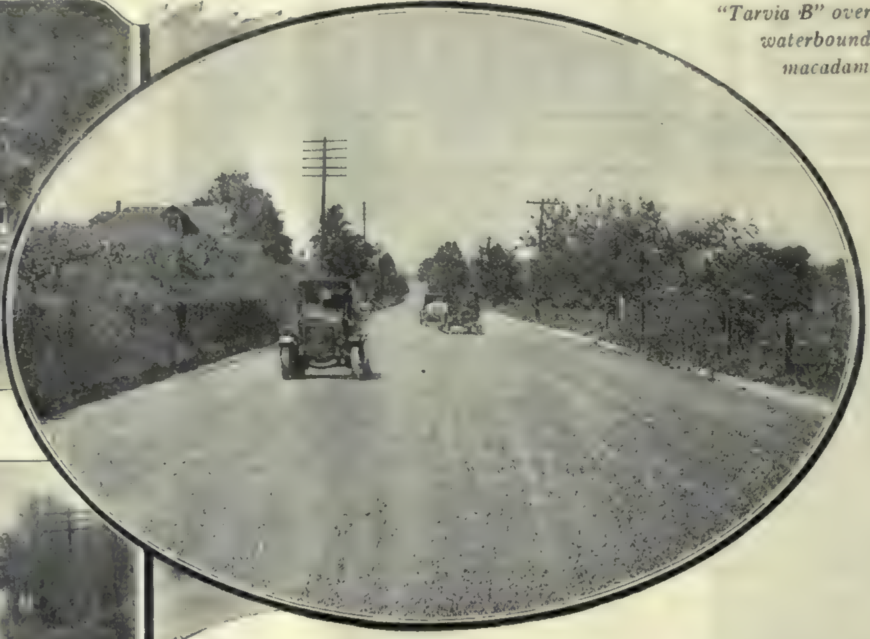
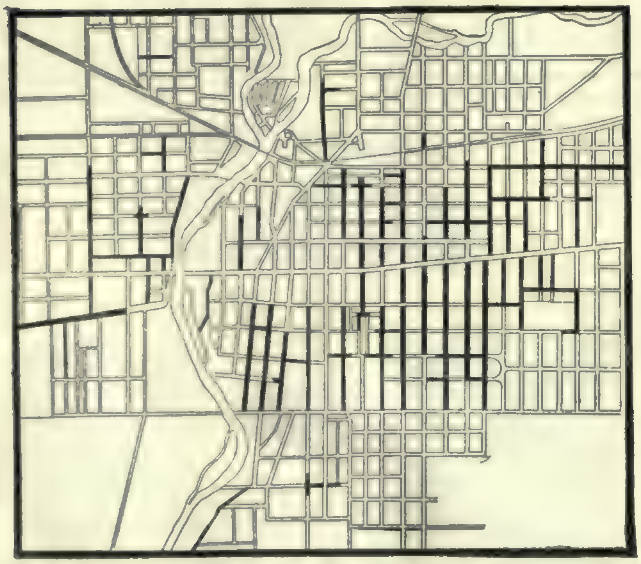
North 15th Street, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Liberty Pike, Richmond, Ind. "Tarvia B" over waterbound macadam

Chester Pike, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Heavy black lines indicate Tarviated Streets in Richmond, Ind.

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Economical Methods of Handling Materials

More General Use of Machinery in Road Construction Will Reduce Handling Cost and Expedite Work

By Lt-Col. H. L. BOWLBY

When it is understood that the cost of handling the materials that enter into the hard surfaced road runs from 10 to 15 per cent. of the total cost of the pavement, the great importance of doing this work economically is obvious.

Road building today is in a machine-made era and the successful contractor is the one who provides himself with equipment suited for economically handling his materials, taking into consideration, of course, local conditions and the available supplies of such materials.

The equipment required depends, first, upon the character of the improvement, whether it is an earth road, gravel road, water-bound macadam, bituminous macadam, asphaltic concrete, bitulithic plain or reinforced Portland cement concrete or brick road. Given the character of road to be built, the selection of a proper plant depends upon the size of the job and local conditions.

Types of Machines Used

The common materials to be moved and handled are: earth, sand, gravel, crushed stone, cement, water, hydrated line, steel reinforcement, asphalt, brick and stone screenings.

The principal new departure in the moving of earth excavation has been the recent development of the use of caterpillar tractors with very large road scrapers and the use of mechanical subgrade planes for trimming up the subgrade to the established grade line immediately ahead of the laying of the pavement.

Sand, gravel, broken stone and stone screenings are handled today by the large contractors with machinery. Mechanical loaders are used for filling motor trucks or railroad cars. Locomotive cranes, mounted on caterpillar treads, are much used for handling these materials by means of clamshell buckets. In some instances locomotive cranes, mounted on standard or narrow gauge railroad trucks, are used, especially in the large central material yards. When the sand, gravel, broken stone and cement are transported from a central material yard to the mixing gang on the road, small cranes are used to transfer the large batch boxes from the motor trucks or industrial railway to the concrete mixers.

Practice in those states that are doing the greatest amount of concrete road building, seems to be standardizing on the use of narrow gauge railway equipment for hauling the mineral aggregates to the mixers on the road. The trains consist of gasoline or steam locomotives pulling flat cars which carry a number of batch boxes, each containing a full batch for the mixer. The track is laid along the shoulder of the road. Turnouts and switches are provided as needed and moved at night so as not to interfere with the next day's work. Some contractors are hauling the batch boxes of aggregates with motor trucks from the material yard to the mixer. It is constantly becoming more popular, however, to permit the mineral aggregates to be piled on the subgrade and have the mixing gang work through them.

Water is supplied to the mixer and for curing the concrete pavement by means of a pipe line laid alongside of the road. This practice is almost universal.

In some states the wet mixed concrete is being hauled from a central mixing plant to the road in much the same manner that the "hot stuff" is hauled out from a central asphalt mixing plant to an asphalt pavement under construction. The hauling of this wet mixture is done mostly with dump trucks of various kinds.

Handling Stone, Sand and Gravel

The mineral aggregates in a central material yard are handled nearly altogether by machinery. A locomotive crane with clamshell bucket usually unloads the sand, gravel or stone from the cars or scows to large storage piles. From these piles the materials are transferred to appropriately arranged bunkers by means of cranes and clamshell buckets. The batch boxes, whether to be moved to the job by motor-trucks or by industrial railway, are filled with the proper proportions of fine and coarse aggregates from the bunkers. Many ingenious measuring devices are used at the bunker gates for proportioning the sand, gravel or stone as the batch boxes are filled.

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*Abstract of a paper presented at the Ninth Annual Convention of the Canadian Good Roads Association, June, 1922.

In the construction of bituminous roads, the mineral aggregates are handled in much the same manner as above described for concrete roads. The chief difference is that the bituminous-concrete or "hot stuff" is always mixed at a central mixing plant and then hauled to the road, dumped, immediately spread and rolled.

The asphalt is usually transported to the central mixing plant in barrels or metal drums, although in some instances it is brought to the plant in tank cars or tank motor trucks. The handling of the bituminous material from the barrels or tanks to the mixed is universally accomplished by means of large melting kettles and small pumps which left the hot asphalt to the measuring bucket immediately over the mixer.

When motor trucks are used to transport the mineral aggregates to the pavement laying gang, it is usually necessary to provide mechanical means for turning the trucks around on a comparatively narrow roadway. There are on the market a number of turn-tables which accomplish this purpose satisfactorily.

There is a great tendency today among contractors to over-equip, to purchase too much plant for the job. The wise contractor has available just enough machinery and equipment. When he is over supplied with equipment he loses money in several ways. Among these are excessive overhead and depreciation, and a general slowing up of the work due to too many "tools" on the job. The wise contractor also hires the best superintendent of construction available, knowing that a hundred dollars extra per month on this expense means many thousands of dollars saved on handling costs.

The greater part of the hauling of road materials since the end of the World War has been done in the United States with motor trucks. This practice has been adopted in all of the states. One of the principal reasons for suddenly changing from horses and wagons to motor-propelled vehicles has been the free distribution by the Government to the State Highway Departments of surplus motor trucks. During the past three years there have been thus distributed approximately 30,000 motor trucks of various capacities. The further distribution of several caterpillar tractors of 5 and 10-ton capacity, has given an impetus to the more economical handling of earth excavation. But few communities that have made a trial of moving materials by motor trucks and tractors will go back to the old method of using horses and wagons.

The Use of Paint on Roads to Direct Traffic—II

How It Aids in Simplifying the Parking Problem; Types of Paints Employed and Method of Application

By JAMES R. McCONAGHIE

The enormous increase in the number of automobiles within the past few years has greatly aggravated the question of traffic control. One of the most important elements in this question today is that of providing adequate parking facilities in the downtown districts. Various methods have been tried of ranking and parking, and in every case it was found advisable to use paint as a means of direction and guidance. Ranking means standing vehicles behind one another paralel to the curb. Parking means standing vehicles alongside one another at an angle to the curb. When vehicles are ranked, no one of them can move out of line independently of the others unless considerable space is allowed between them, thus causing a waste, whereas when they are parked, being parallel to one another, any one of them can move out of the parking space without causing any other one to move.

In considering the question of ranking or parking we find many difficult complications. Here we must preserve the rights of all and at the same time refrain from imposing more restrictions on any one than is absolutely necessary. There is no reason why a vehicle should not rank or park anywhere where warranted by the width travel along the rural highways are making it necessary of roadway, providing that he does not trample on the toes of the next fellow. In downtown districts where the importance of getting to the curb is paramount, it is absolutely necessary that the driver remain with the car in order to give way to an incoming car, or that time limit restrictions be placed on the area. The former applies more directly to ranking spaces in front of shops, while the latter applies to other districts where cars are to be left for a time. There are many spaces which should be regarded as natural ranking or parking spaces, according to the amount of room which can be allotted without restricting the flow of traffic on the roadway. Such spaces are better marked out with paint limit lines. Among such spaces are those alongside parks, vacant lots, public and vacant buildings, and buildings where the doors or entrances are not in use. There areas should be well marked out and the public should be informed of all rules and regulations in regard to them.

The general dimension of these parking or ranking spaces are suggested here. For ranking spaces marked in the middle of the street the side lines should be at least 6 ft. apart. If at the curb, one line 6 ft. from the curb line should be used. It is sometimes advisable to have arrows painted within these spaces alloting the area and to show direction. Parking places should have stalls not less than 8 ft. nor more than 9 ft. wide for vehicles marked with paint lines. Special stalls for trucks or sight-seeing busses should be wider. Vehicles should be parked at an angle to the curb of 90 degrees, 45 degrees, 37½ degrees or 30 degrees, as best adapted to local conditions. The width of a parking space located in the middle of the street where vehicles are to be parked at an angle of:

90 degrees should be at least 15 ft.
45 degrees should be at least 15 ft.
37½ gedrees should be at least 14 ft.
30 degrees should be at least 15 ft.

Where parking spaces are next to the curb, these widths can be reduced 1 ft. each, respectively, as a portion of each vehicle can project over the curb about that much when necessary. Vehicles should never be parked at an angle of 90 degrees to the curb except in certain locations when waiting for the termination of the races, theatre, ball games, etc., or when loading or unloading merchandise, and, in some instances, taxi stands. When vehicles park they should drive directly into their stalls and back out when ready to leave. This method will avoid serious retarding of other traffic if the time chosen to back out is when there is a slight let-up in traffic.

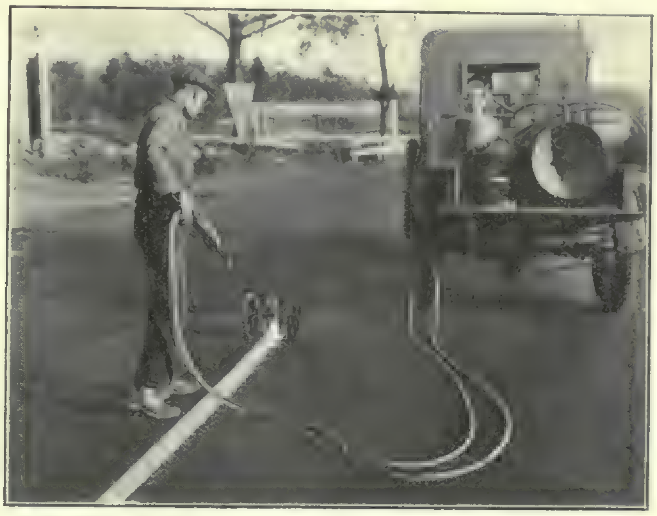
How Detroit Establishes Traffic Lanes

By the use of painted strip traffic turning right is direct near the curb, straigh through traffic to the center, and traffic turning left to the outside. Each lane is clearly marked: "Right Turn," "Thru," "Left Turn."

In painting these areas, the strips should be of white paint and of at least 4 in. in width. It is sometimes advisable to have painted arrows indicating the direction, but these may be left out.

While the most intensive use of painted parking areas is in the downtown areas, still we find a great need of them at various types of parks or recreation grounds. In general, any place where there is liable to be a congestion of traffic and where there is sufficient reason to cause much stopping, there is need of specially designed parking areas. The increased amount of travel along the rural higways are making it necessary to provide cut-outs along the highway. These are for venders' carts or for places where repairs can be made. An example of such a need is found along the road to Lexington and Concord. A trip along this route on a Sunday will convince anyone that some such method should be used to eliminate a lot of delay and traffic congestion.

Another place where paint is now being extensively used to direct traffic is in the division of roadways into lanes, thus separating the traffic. We find first the simple straight line down the center of the road, serving as a dividing and direction line to traffic on the highways and rural districts. This dividing line is found mostly around curves, preceding bridges or narrow places in the road, or at any place where there is a danger from overlapping traffic. The shape and size of these lines vary in different sections, from the continuous line through the dot and dash method to one of a line of dots. All serve the same purpose, but some use less paint than others and are accordingly cheaper. The average width of these lines is 4 to 6 in. The dots have an average diameter of 8 in. In coming on a curve, the line should start at least 50 ft. on the straightaway before the curve is reached, and should continue along the curve to a similar point on the other side. On a gradual curve it may only be necessary to have a line at the start, again around the most dangerous part and at the finish.



Applying the Paint to the Road

This type of equipment is employed by the Massachusetts State Highway Commission. It was designed by the Spray Engineering Company of Boston, and will paint a strip as fast as a man can walk.

Besides the single dividing line, with which we are all familiar, there is in operation a system of from one to three lines on the busiest streets of many of our larger cities. It has been found that by placing series of lines on the pavement, dividing the space up into its maximum number of traffic lanes, that a greater speeding up of traffic has been the result. A study is made of a particular street as to its width, the kinds of traffic that make the most use of it, and the number of principal thoroughfares that cross it. After this study it is possible to say how many lanes it is advisable to divide the street into. Perhaps it may be found that two lines are sufficient, one dividing the greater part of the street into two traffic lanes and one for parking or ranking usage. Or it may be foud that the street is wide enough and busy enough to warrant as many as three lines placed equidistantly apart, thus dividing the street into either four traffic lanes, two going each direction, or into two traffic lanes and two parking lanes. In the case of the four traffic lanes, a further expediting of traffic is to insist on an understanding of the right and left-hand turns as described by the city ordinances. For example, in Boston there is a regulation that a driver wishing to make a left-hand turn must get into the inner side of the traffic line, and in making the turn go in front of the traffic officer. He will not permit a driver on the right-hand side of the line of traffic to make a left-hand turn. Likewise a man wishing to make a right-hand turn must keep to the right of the traffic line. Through traffic is advised to keep to the right so that it will not be interfered with by the cars wishing to make the left-hand turns. One can easily see how traffic guide lines painted on the road will assist in the enforcing of such regulation.

Width of Lanes

Care must be exercised in the division of the street area into more than two parts if a further division will make the lanes too narrow. For example, a street wide enough for only three lanes or any other odd number cannot be divided into more than two or its multiple of parts, otherwise it is found that there is a danger of much straddling. Where there is plenty of space, it has been found that the traffic conforms very quickly to the lined areas, and there is adequate proof that traffic is speeded up with much less congestion. In one-way streets a similar division of the street area has been found very useful. Many times on a busy street, where car tracks are found, they serve as excellent dividing lines, even though they are not raised above the street surface, but it has been found that there is more of a tendency to straddle them than in a similar instance where painted lines are used. An example of the use of care track areas as traffic lanes in themselves is to be found in Boston on Washington Street between Franklin and Essex Streets. Here the regulations give the pedestrian the right of way from the building line to the outside car track, vehicular traffic being confined to the car track area. This regulation is in force from 10 A. M. to 6.30 P. M. It can be seen how painted strips on similar busy streets can perform a like function.

A further possibility of a use for the painted lines is the division of the street traffic into fast and slow traffic. This method has been tried out in some places and found very useful. We all know how, in certain sections of the city, the horse-drawn vehicle slows up the traffic. The plan is to provide a lane for the exclusive use of such slower moving traffic, and it is easy to see how much congestion can thus be avoided. This method is quite applicable to many of our market districts especially.

In all cases where the painted strips are used they must be wide enough to give a sense of division and protection. There is a feeling of weakness or fragilness where too thin a line is used, and it is found that their silent commands are not as well obeyed as where the line is much heavier. As a general rule no line should be less than 4 or more than 8 in. wide. In the case of using a line of circular dots, the diameter of these dots should never be less than 8 in. It must be remembered that these lines must be seen easily if they are to be followed.

Various Kinds of Paint in Use

Nearly all of the larger paint concerns in the country are putting out a specially prepared road paint. For example, the John Lucas Company have on the market a zone white-marking paint that has been found fairly fills to the bill. This paint is used by the Massachusetts Highway Commission. The Parr Paint & Color Company of Cleveland have on the market "Traffic Zone White Marking Paint" that the City of Cleveland has found fairly satisfactory. Detroit has its own formula that it uses extensively: 50 lb. lowest grade white lead, 175 lb. whiting, 6 gal. gloss oil, 20 gal. common gasoline, 1 oz. ultra-marine blue. Place the white lead in a barrel with head removed from one end and thin with about 2 gal. of gasoline. Add the whiting and stir thoroughly. Then add the balance of the gasoline and mix well. Add the gloss oil ,thin the ultra-marine blue with about one-half pint of gasoline, add to the mixture and stir thoroughly. This will make about 35 gal.

There are constantly appearing on the market new patented paints, and at present the Massachusetts state chemists are experimenting with ten such. The problem with the experimenters is to find a lasting paint that will dry rapidly and stay white the longest. In all cases it is found that a lead base paint is objectionable because of the sulphur in tar and asphalt forming a black or yellow compound when the paint is applied. The use of gasoline greatly reduces the life of the paint. The use of such material as whiting, which is initself an inert subject and does not become an integral part of the paint, while adding to the white qualities, lessens the life of the paint. It is thought a zinc oxide compound would be much better. The expensive part of paints are the compounds of manganese or drying elements, and these need the addition of oil to function, and oil is slow in drying and cannot be hurried by artificial methods. The amout of time needed for drying the various paints on the market today vary from one hour to seven minutes. The Detroit mixture dries in about ten minutes, but needs to be replaced every ten days or so. The Zone White, of the John Lucas Company, dries in about half an hour, and the Massachusetts Highway Commission has found that only three applications a year are needed.

(*Concluded on Page 62*)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
Editor

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

Vol. LXIII. August 16, 1922 Number 7

HIGHWAY COSTS AND THE MOTOR TRUCK

Not until the truck operator shall contribute his due proportion to the cost of highway construction and maintenance, can his right to use the highway be considered equal to that of the ordinary taxpayer. This is the conclusion of the Public Utilities Commission of Colorado in a decision rendered March 8, 1922.

The Colorado Commission held that through abuse of the highways by inadequately taxed buses and trucks, "the 137,336 passenger car owners of the state are grieviously wronged" and "the farmer and the city home owner pay the bills."

In a similar decision, June 14, 1921, the Public Service Commission of Pennsylvania declared, "public interest would immeasurably suffer" if auto lines were permitted to engage in destructive competition with railroads that were providing reasonably adequate service to their territories. The Pennsylvania Commission in a decision March 16, 1921, refusing to permit an auto line to parallel an electric railway, pointed out that the proposed competition would mean either increased rates or impaired service for the patrons of the electric line.

These decisions are important because they enunciate first principles relating to regulation and taxation of highway carriers and have vital bearing on conditions in every western state today.

No form of extravagance in American life equals the bad road, and a distressing fact is that so few self-appointed watch dogs of the treasury know it.—*Bulletin Associated Pennsylvania Highway Contractors.*

HIGHWAYS IMPROVE UNDER BABCOCK PLAN

Reductions of more than $1,500,000 in road tax levies by counties and townships in Minnesota followed the first year after adoption of the Babcock plan for state improvement and upkeep of 7,000 mi. of main roads which always before had taken a large part of local road and bridge funds, according to a recent bulletin of the state highway department. Official figures from the state auditor's abstract show that last year for the first time in state annals the county road and bridge levies dropped to $10,022,488 from $10,843,682, and those of the townships to $6,139,673 from $6,862,560; a total decrease of $1,543,000. The current funds for local roads and bridges are $19,811,278, however, and the heavy traffic roads, always the most costly to build and maintain, are taken over by the state. Current revenues in the trunk highway fund this year probably will approximate $7,500,000, the bulletin continues. This is about $500,000 more than last year, but still far below the $10,000,000 annual average expected, and due in part to a cut in federal aid, which cost the trunk fund nearly $3,000,000 this year and last. Motor vehicle tax revenues for 1922 have passed the $6,000,000 mark, compared with the 1921 total of $6,616,000. Rates are unchanged, but a larger number of cars are registered.

Reports from all points on the Pacific Coast are to the effect that road construction costs are coming down. The best evidence of this seems to be the under-bidding of engineer estimates in frequent cases. At Yakima, Wash., ten contractors bid on graveling 11 mi. of the Summitview-Tieton-Cowiche road and of nine bidders only one was above the figure of the county engineer, whose estimate was $81,360. Most of the contractors were $10,000 under the estimate, while the successful bidder was $20,000 below.

ARIZONA TO SPEND HALF MILLION FOR FOREST ROADS

Nearly half a million dollars will be expended in the improvement of highways through national forests in Arizona during the ensuing fiscal year as a result of approvals of various projects signed by the secretary of agriculture. About one-half of this sum will be expended on through highways in response to the request of the Arizona Highway Department that all federal aid forest funds be concentrated on the 7 per cent system of main thoroughfares, until the system is completed.

The amounts authorized for the various approved projects in this state represent the full appropriation of Arizona's allotment of forest road funds for the fiscal years 1921-22 and 1922-23. Authorization of additional forest funds, however, are contained in the postoffice appropriation law which was approved June 19, 1922. A total of $6,500,000 is authorized for forest roads in the United States for the fiscal year 1923-24 and the same amount for the fiscal year 1924-25.

RUBBER FOR SURFACE DRESSING

In a recent report to the Department of Commerce, in Washington, Consul Vance, of Colombo, Seylon, tells of experiments being carried on by the Colombo municipality in the use of rubber as a road surface dressing. He states that the dressing, which is the invention of a Ceylon rubber planter, is being used on a portion of Darley road, which is one of the most used thoroughfares in Colombo. This solution was first tried on a road of the Deviturai rubber estate, where it has been in use for the past 13 months. A short stretch was later laid in the municipality of Galle. The present test, however, according to the consul, is the hardest to which the new solution has been put. It is made from pure bark and scrap rubber. The experiments so far show that the solution is easier to handle than tar. The material is made from a secret formula, and the inventor is still working toward its perfection.

CONTRACT LET FOR MODEL AMERICAN ROAD

The far-famed stretch of model road known as the Ideal Section of Lincoln Highway is, after nearly two years of preliminary research and detailed work, now under construction in Lake County, Indiana. The contracts for the construction were closed recently in Indianapolis, when Stone & Webster, Inc., of Boston, Mass., acting as agents for the Lincoln Highway Association, undertook to build a section of road which will cost, with all appurtenances, approximately $100,000 per mi., at a price of $33,000 per mi. to the State of Indiana. Stone & Webster, under whose supervision the work will proceed, let the construction contract to J. C. O'Connor & Sons of Fort Wayne, Indiana. Already the work on this stretch, which will perhaps be one of the most talked about and studied sections of highway in the world, is under way.

In addition to the $33,000 per mi. provided by the state, Lake County authorities have assured $25,000 from the county funds, and steps have already been taken by the Lake County Council and Commissioners to provide this sum as the county's share. The extra expense of the section beyond the sum supplied by the state and county, which is equivalent to what the construction of the usual state specifications would cost, will be met by the Lincoln Highway Association, through a special fund provided by the United States Rubber Company. It is expected that the paving work will be completed by the end of October, many details, including the lighting installation, the beautification of the right-of-way, etc., remaining for accomplishplishment next spring.

In the design of this unique section of the Lincoln Highway is embodied the mature thought of 15 of the foremost experts in highway engineering and construction and related problems in the United States who, acting without recompense as the Technical Committee of the Lincoln Highway Association, developed the general plan which was carried to detailed completion through the collaboration of the engineering department of the Indiana State Highway Commission. C. Gray, State Highway Engineer, Lockwood, Greene & Company, Engineers, and W. G. Thompson, late State Highway Engineer of New Jersey, the Association's Consulting Highway Engineer. Federal Aid of $20,000 per mi. has been allowed by the U. S. Bureau of Public Roads towards this construction, the development of which will be closely followed by the federal authorities.

The ideas embodied in the design of the Ideal Section which will stand for years at its central location on the Lincoln Highway as a model for the gradual evolution of the entire route as traffic volume increases, impress many important lessons through which the association hopes to inform and mould public opinion of the United States.

The design calling for 40 ft. of 10-in. reinforced concrete pavement, capable of carrying a traffic of 20,000 vehiclse per 24-hour day, one-quarter of which are estimated to be heavily laden trucks, impresses the necessity of permanency in our modern highway investments on main routes of travel. The width makes for safety and facility of operation. The absence of drainage ditches at the side of the road further inculcates the safety idea, while the night illumination increases the road's efficiency by permitting a heavy volume of night traffic without danger. The beautification of the roadside is in line with steps now being taken by the most advanced highway departments, which are realizing that too little attention has been given in this country to the importance of a proportionately small expenditure to realize the greatest beauty of the roadside.

MISSOURI HAS OVER 4,000 MILES OF HARD-SURFACED ROADS

During the past few months the Missouri Highway Department has been compiling records from the various counties of the state for the purpose of ascertaining the total number of miles of hard-surfaced roads, and up to the present time the tabulation shows 4207 mi., classified as follows: Gravel macadam, 3898 mi.; bituminous macadam, 175 mi.; concrete and brick, 134 mi.

The State Highway Department has issued a map showing the number of miles of hard-surfaced roads in each of the 114 counties of the state.

BOOM IN HIGHWAY BUILDING DUE TO FEDERAL AID

Federal aid has been probably the most important factor in the big boom in highway building of recent years, and there are now many long stretches of trunkline highway serving rich agricultural and industrial sections of the country which are almost entirely Federal-aid construction.

The United States Department of Agriculture, which administers the Federal-aid fund, points out that a traveler going from Richmond, Ind., to St. Louis across Indiana and the southern part of Illinoois, a distance of approximately 679 miles, would travel 505 miles, or 75 per cent. of the way, on Federal-aid highays, practically all of which should be in service by the end of the present season.

Equipment — Trade — Materials

TRAFFIC CONTROL LIGHTING EQUIPMENT

Since the automobile has come into general use, there does not seem to be any "stop" to traffic. The first 300 cars were manufactured before 1903 and up to 1912 only 800,000 had been manufactured for use. In 1921 the number registered was 10,505,660 and this does not mean that next year there will be less. On the contrary, the increase in traffic will never stop and, therefore, it is an acute and timely problem for every city to consider how this traffic can be controlled or regulated.

Poor regulation of traffic involves:

(1) Accidents. Many people are injured and killed through not understanding traffic signals.

(2) Collisions. The loss in dollars and cents, on account of collisions between cars and damage to people's property in general, runs into millions of dollars a year through misunderstanding of traffic signals.

(3) Increase fire hazards. This item is difficult to estimate, but if through a tie-up or congestion it was impossible for fire apparatus to pass a given street, in responding to an alarm, what would you estimate the cost of the congestion would be for just one such fire?

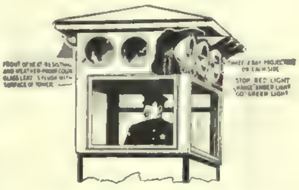
Over a year ago Detroit, the automobile center of the world, realizing that the traffic problem was becoming very serious, installed an experimental traffic tower on which were located signal lights in the standard colors:

"Red"—To indicate "Stop."

"Amber"—To indicate "Change of Traffic."

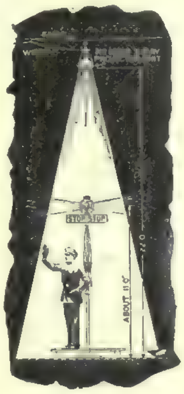
"Green"—To indicate "Go."

As a result of constructing this tower twelve new ones are now being built, with same general equipment. The signal lights can be controlled automatically with an interval of about two minutes between the red and green lights. Powerful concentrating reflector equipment, with color lenses, are to be mounted flush with the surface of the tower end, by using either 150 or 250-watt round ball lamps, the signals will be visible at a distance of one-half mile during the day, and at an even greater distance at night.


FRONT OF HEAT RESISTING AND WEATHER-PROOF COLOR GLASS LENS FLUSH WITH SURFACE OF TOWER
THREE X-RAY PROJECTORS ON EACH SIDE
STOP RED LIGHT
CHANGE AMBER LIGHT
GO GREEN LIGHT

These traffic towers are constructed of concrete, reinforced, and provided with all the comforts temporarily required by patrolmen. To warn the traffic of the approach of fire apparatus or, in the case of emergency, an electric horn is provided and all signals canbe made to indicate "Stop" with the red light by a master switch. Baltimore has constructed such an experimental tower, with very fine results. One item that it is important to remember is that the reflector and color lens equipment must be of a permanent nature, to withstand not only the heat of the lamps, but the lenses exposed to the weather must not deteriorate, either from dampness or heat. It is necessary to use some method of shielding the lens from the direct rays of the sun during the earlier and later hours of the day. This has been overcome by using shields and, in some instances, by a frosting, or etching of the lens, which prevents a reflection from the rays of the sun.

Still another method of traffic control lighting is the use of a spotlight for the patrolman and his traffic signal. This was originally designed for Camden, N. J., by Mr. J. W. Kelly, Junior Chief of the Electrical Bureau. It consists of an X-Ray projector, mounted on a goose-neck on the street post, or suspended on a guy wire, as shown in the diagram. The reflector used in this unit is very concentrating and when used with a 200-watt standard lamp throws a beam of light 6 ft. in diameter, that makes the traffic officer and his signals stand out very clearly at a distance of even 1,500 ft. away. Of course spotlight equipment can only be used at night and is, therefore, only suggested in localities where the traffic is particularly heavy during the evening hours.



"Don't let traffic run wild" might be an appropriate slogan for those responsible for the regulation of traffic in the various cities. Certainly the increase in the number of automobiles in the past ten years and the prospects for growth in the future warrant consideration of proper methods of regulating traffic, not only by having streets on which the traffic moves in only one direction, but in controlling it so as to eliminate, as far as is humanly possible, accidents, collisions, fire hazards and to make it safe for pedestrians and drivers alike.

It is impossible to go back to the days of the horse and buggy when there was plenty of room on the street. It is just as impossible to widen all of the heavy thoroughfares to accommodate the increase in traffic that we have since the days of the horse and buggy. The engineers of the National X-Ray Reflector Co., who have, through courtesy, furnished the photographs used in this article, will be glad to co-operate with anyone on their traffic signaling problems.

The Bureau of Public Roads recently reported that road grading costs have reached a stable basis. In 1917 the average cost for grading on Federal Aid roads was 38 cts. a cu. yd., but in 1920 it reached 66 cts. During the three months ending August 1, 1922, the average price per cu. yd. for the whole United States was 33 cts.

USE OF PAINT ON ROAD TO DIRECT TRAFFIC

(*Continued from Page* 58)

The life of the painted strip varies again as to its location, and the kind of paving upon which it is applied. It has been found that paint applied on brick, asphalt, concrete or wood block lasts the longest. The shortest life is on the cobble-stone roads, while the roads with an excessive amount of tar soon cause the paint to discolor. Where concrete paving is used extensively it has been found that a black paint serves the purpose and lasts well. In general, we can say that no paint at present upon the market fills the bill entirely, and every city is constantly experimenting with new productions.

Methods of Applying Paint

In the application of the paint it has been found that that applied by hand has been the most satisfactory. A preliminary chalk line is placed where the intended paint line is to go and the paint applied with an ordinary brush. The drawback to this method is its slowness and the irregular line that often results. Two methods of machine application are used. Detroit uses the ordinary lawn tennis marker, sold by A. G. Spaulding & Brothers. The outlet being palced about 2 in. above the bottom of the tank to prevent sediment from clogging it, and a small paint brush is inserted in the distributor. This method has been found nearly as good as the hand method and much quicker.

The Massachusetts Highway Commission uses the "Spraco Pneumatic Highway Marker." It is mounted on a truck with a gasoline engine driven compressor. The compressor, material container, etc., are carried on the truck. A special paint gun is mounted on a gun carriage having large wheels and spray shield. The shields govern the width of the painted bands and are furnished for whatever widths desired. They are constructed so as to permit a vertical movement to take care of any ordinary irregularities in the road surface. The machine is guided by a pipe handle carrying necessary air and paint, with trigger control. The operator proceeds at an ordinary walk, the truck moving along at the same rate of speed. When the operator becomes proficient it is possible for him to sit in the rear of the truck and drag the machine behind. This machine has been found highly satisfactory, but as is the case with the Detroit method, either because of the inexperience of the operators or some mechanical difficulty, the results are not as lasting as when applied by hand. However, the results are so much quicker and cheaper that the use of the machine methods are recommended.

Possibilities Yet to Be Tried Out

As to some of the possibilities of the use of paint that have not been carried out, we might say that the principle of dividing traffic lanes has not been carried to its greatest perfection. It seems to us that in many places where paint is now used that a more careful study of the conditions existing could have been made and a wiser and more efficient use of paint made.

The value of the crosswalks is so great that Captain Hoppe of the Boston Traffic Department strongly recommends the placing of some permanent material, such as white stone, in the pavement. The opinion of all the men in the "know" on traffic conditions is that paint as a guide to traffic is a thing that is here to stay and that it is a mighty valuable aid to traffic direction. However, care must be used to educate the public as to the meaning of the painted strips or confusion may result. And it can hardly be said that a motley array of white lines add much to the beauty of a boulevard.

In conclusion we may say that with the proper amount of care and study paint may be used on road surfaces to direct traffic with great success, and the cry that goes up from Weymouth, Mass., may be considered as a light line of humor when they say:

"It will be a matter of some difficulty for the greenest or most absent-minded driver to go astray in Weymouth regarding either direction or traffic regulations, providing his intentions are good. Beginning at the borders of the town, the motorist will find running comments and instructions in words and in symbols accompaying almost every foot of the way. Crossings, car stops, hydrants, wate rgates, directions for proceeding on the main lines, are only a few of the points of interest to autoists that are painted on the ground. A line painted down the center of the street unmistakably divides the right from the left, and others of the curves keepes the speeders in the narrow, if not straight, path.

"In fact the more captious of the Weymouth citizenry are remarking that the only thing which apparently hasn't been painted on the streets is the local tax rate and the early history of the settlement. All the romance, they complain, will have been abstracted from motoring, and a trip in an automobile will become merely a prosaic process of proceeding from one point to another, instead of adventure. No longer, following twisted signs, will the tourist discover that he has been speeding about the country in a circle, or in a contrary direction to which he wished to go. No more will he have the joy of losing himself and guessing at the names of the towns and villages he passes through. In fact the whole countryside will have become one continuous road map containing all the familiar hieroglyphics which every motorist recognizes and only the occasionl expert understands."

STONE PRODUCTION DURING 1922

About 62,400,000 short tons of stone were quarried in the United States during 1921, according to the U. S. Geological Survey. This is more than 20 per cent less than the production in 1920. The estimated value of this stone is $92,500,000, a decrease of 30 per cent. as compared with 1920. High freight rates are said to have contributed largely to the general depression in the industry.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Vol. LXIII August 23, 1922 Number 8

TABLE OF CONTENTS

The Development of Concrete Road Construction During 1921. By L. N. Whitcraft 63

Sixth Test on Bates Experimental Road 65

Mechanical Equipment of a Highway Department. By Alfred Dryland 66

Expansion and Construction Joints in Concrete Bridges 68

EDITORIALS AND NEWS:

Cooperation 69

Highway Finance 69

Foreign Interest In American Roads 69

Roadside Weeds 69

U. S. Spends 600 Millions for Roads in 1921 . . 70

Experimental Tests to be Made on Oiled Roads . 70

Agreement Reached on Nevada Forest Highway Program 70

Georgia Asked to Spend $75,000,000 for Roads . 70

Highway Work In Minnesota During 1921 . . . 70

Pennsylvania Builds 225 Miles of Roads in 1921 71

Cement Industry at Mercy of Coal Supply . . . 71

A Unique Feat in Bridge Building 71

PERSONAL MENTION 72

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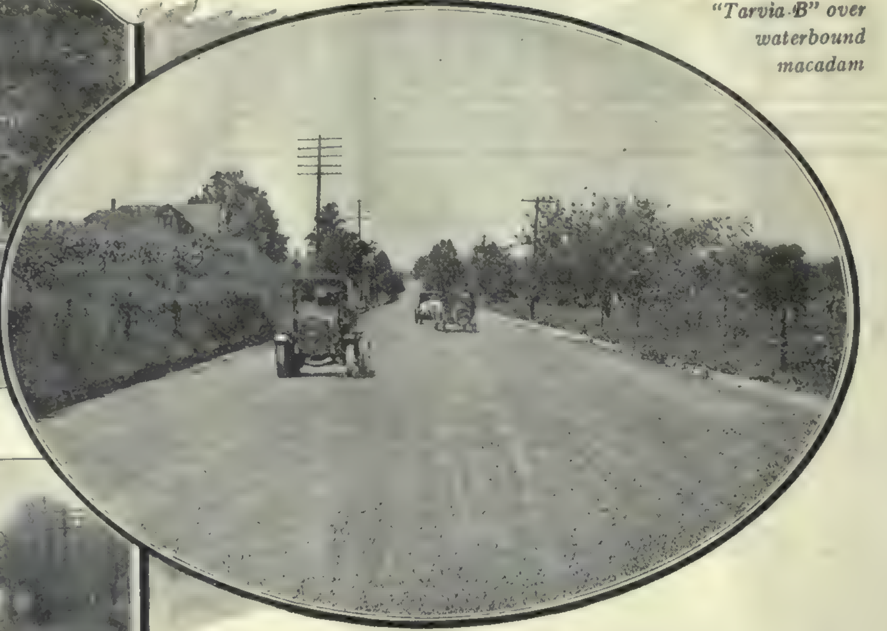
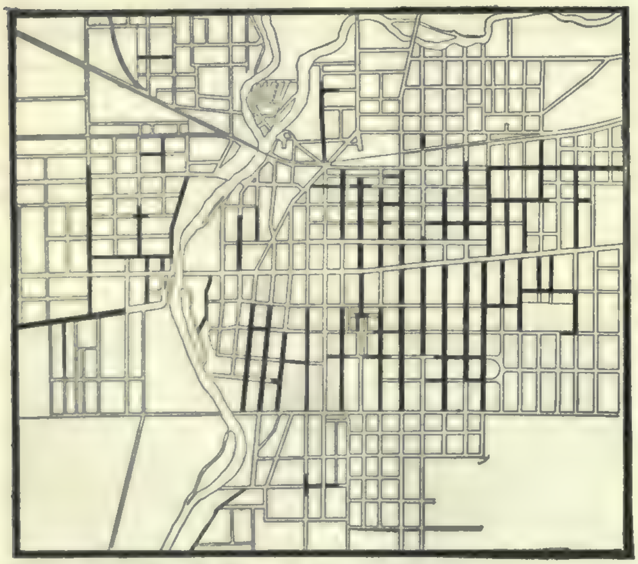
North 15th Street, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Liberty Pike, Richmond, Ind. "Tarvia-B" over waterbound macadam

Chester Pike, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Heavy black lines indicate Tarviated Streets in Richmond, Ind.

Here's what Richmond, Ind. thinks of Tarvia—

Up to four years ago, the streets of Richmond, Indiana, were much like those in hundreds of other towns throughout the country. They were muddy in wet weather, dusty in dry spells and generally "hard going" at any time, both on the traffic and the taxpayers.

But in 1918 Richmond stepped out of the mud and dust and inaugurated a program of mudless, dustless, all-year Tarvia roads. Describing Richmond's experience with Tarvia, Mr. D. B. Davis, Civil Engineer, writes:

"It is with considerable pleasure that I report to you our success with Tarvia. This year makes the fourth successive one in which we have used your materials.

"We have developed here a Tarvia treated gravel pavement which is so popular for residence streets that the demand each year is beyond our ability to construct. Observation of the service rendered by streets which have been surface treated during the past four years has convinced our people of the economy and serviceability of Tarvia for this purpose.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII NEW YORK, N. Y., AUGUST 23, 1922 No. 8

The Development of Concrete Road Construction During 1921*

By L. N. WHITCRAFT

Field Engineer Portland Cement Association

During the past season the construction of concrete highways underwent radical changes. In brief the more important of these and their general functions are as follows:

Center Longitudinal Joint. This feature divides the entire pavement slab longitudinally and permits of pouring the full slab width in one operation. The diversion of the pavement longitudinally increases its beam strength about four times and further precludes the possibility of longitudinal cracks.

Doweling of Transverse Joints. The use of dowels add additional reinforcement at the joints and hold the adjoining slabs in the same relative position. Dowels should be especially effective at the corners of the slab which are naturally weaker than adjoining sections.

Inclusion of Heavy Mesh and Bar Reinforcements—In either Single or Double Layers. The advantages of the heavier steel reinforcement, within reasonable limits, should be obvious for the reason that it gives the pavement greater structural strength and greater resistance to sub-grade changes. To more successfully resist both factors it is used, when deemed desirable, in both top and bottom of the slab and in either mesh or bar design.

Laying of a Uniform Thickness of Slab. The weakest point of support of a pavement is at the sides which are usually left unprotected and are subjected to as great a load as is any part of the pavement. It is to secure greater strength, or the same strength at the sides as at the center that a uniform thickness of slab is designed.

Thousands of Aggregates Direct to the Mixer Without Same Being Placed on the Sub-Grade. This requirement, of necessity, leads to the central proportioning and loading plant and permits of and facilitates an accurate centralized unloading plant. The keeping of the sub-grade free and clear from material stock permits of more accurate workmanship in the preparation thereof so that with no subquent obstructions or disturbance the sub-grade should be found both true to grade and cross-section at the time of placing concrete.

At first thought these changes in design gave one the impression that we are getting beyond reasonable economic limits. Such, however, has not proved to be the case. On the other hand each and every feature has apparently well performed the function for which it was designed and without unduly increasing the cost of these highways.

Center Longitudinal Joints

The construction of the center longitudinal joint and the finishing of the groove directly over same has been greatly simplified and perfected by the placing temporarily, of a 2-in. metal cap upon the 1/16-in. dividing sheet. This cap consists of two ⅛-in. by 2 in. strips of iron and one 1 in. by ⅛ in. strip of 8 to 10 ft. lengths riveted together with the 1 in. strip between the 2 in. strips. With the metal dividing sheet placed upon the sub-grade and coming within 1 in. of the finished surface the placing of this cap upon same brings its top surface to finished grade. When properly staked this permits the placing of concrete and finishing over the full width of pavement. In addition thereto the metal cap so placed gives sufficient rigidity to insure the dividing sheet remaining in a true line and perpendicular to the sub-grade.

After final finishing of surface is accomplished and the concrete becomes sufficiently stiff to hold its shape the metal cap is removed. The edges of the groove so formed are then rounded with an edging tool of ½ in. radius and the groove is ready for pouring with tar or asphalt at any time after the concrete hardens and before the pavement is opened to traffic. Care should be taken, however, not to obtain a groove of greater than 1 in. opening across the top, the reasons for which are obvious.

Doweling of transverse joints by the installation of iron rods is an easily accomplished construction feature. Nevertheless it should be carefully done in order that these rods shall be parallel to both the finished surface and the axis of the pavement. It is also very essential that one-half of the length of each rod is so protected by wrapping that there is no bond with the concrete. Also that a space for longitudinal slab movement is provided at the end thereof. Failure to properly provide for these features may cause a rupture or spalling.

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* Abstract of a paper presented at the 1922 Convention of the New Jersey Highway Association.

New Designs In Reinforcement

With respect to the use of the new designs in reinforcement far better construction results are to be had in the use of the bar or heavy mesh reinforcement than with the lighter types of mesh. This is due principally to the greater rigidity of the heavier reinforcement and the recently designed methods for accurately supporting same in place by the use of pipes laid upon the sub-grade. Where the double layer of reinforcement is used the accurate spacing apart of the mats is simplified by the use of "chairs" which are fabricated with the mats. Better yet, this can be accomplished by the inclusion of deformed or bent members in the makeup which serve as "spacers" and have a definite reinforcing value as well. These methods of supporting and spacing apart of the double layer of fabricated mats have one great advantage in that this so-called "cage" of completely fabricated double layer reinforcement permits of pouring the concrete in a single full course depth. This is also a distinct advantage over the old practice of placing a course of concrete then a layer of reinforcement by another course of concrete, especially when dry concrete is used.

Uniform thickness of slab requires no different construction than the pavements of greater thickness at the center than at the sides, other than in the former sub-grade is shaped to the specified crown, which is usually 2 in. or less. while in the latter the sub-grade is flat. The impression prevails that the crowned sub-grade is preferable to the flat one principally because of the fact that it drains off and dries out more rapidly. This is a desirable feature in connection with progress and the preservation of good sub-grade conditions.

Handling of Aggregate

No one feature in the construction of concrete highways has been productive of more highly desirable results in character of workmanship and quality of these highways than that of keeping the aggregates off the sub-grade. As a result we now find anywhere from one to twenty batch units being delivered to the mixer all proportioned accurately alike which makes for greater uniformity of concrete. The properly prepared sub-grade, at all times unobstructed, should insure the required thickness of pavement at all points. With this requirement in effect one can readily tell whether or not the specified thickness of pavement is being placed. Another feature is the facility with which the sub-grade can be restored to its proper condition in case of disturbance by rains or other causes, such as the development of weak spots due to unsuitable sub-grade material which it may be necessary to remove.

The thought prevails generally that heavily reinforced concrete pavements do not crack, and it has been with a view to eliminate cracks that the reinforcement feature has been given so much consideration. Admitting that this effort has met with a great measure of success, we must at the same time acknowledge that the results are not quite up to our expectations.

It is a generally accepted theory that cracks are due to frost action, changes in temperature and unequal bearing power of the sub-grade. Yet if these were the only causes the heavier designs of reinforcement would serve to more nearly eliminate them.

From an observation of the methods of construction of these pavements I am led to believe that the most successful and effective method of eliminating cracking is the use of reinforcement together with the *proper protection and procuring of the concrete during the early hardening period.* It is during this hardening period, when the concrete has little or no strength to resist shrinkage, that transverse or shrinkage cracks occur. It is also during this period that the reinforcement is of little or no value, for there is no bond until the concrete hardens.

Curing of Concrete

To offset this shrinkage, sometimes called contraction, during the period between the time the concrete is placed and the time it sets, and has strength, it is absolutely essential that effective curing be had immediately following the time of final finishing of the surface in order that this cracking might be eliminated. The development of this cracking as a result of too rapid drying out and ineffective curing is far more apparent in long length slabs than in the shorter ones. It would therefor seem that the slab lengths should be greatly dependent upon the effectiveness of the curing to be done.

Another advantage to be gained as a result of effective curing is that concrete properly cured by being covered and kept constantly moist as provided for in your standard specifications will show much more compressive strength of about 4000 lb. per sq. in. and a corre-been allowed to dry out too rapidly. It is true that any and all factors that tend to produce strength in concrete also tend to increase its wearing qualities. As an illustration of this, at the end of 4 months the compressive strength of a concrete of a given consistency was about 1700 lb. per sq. in. when it was allowed to dry out in the air unprotected, while exactly the same concrete stored in damp sand for the first 21 days gave compressive strength of about 4000 lb. per sq. in and a correspondingly less wear in the rattler tests. In short, proper protection and curing for a period of 10 days means an increase in strength and resistance to wear of approximately 100 per cent.

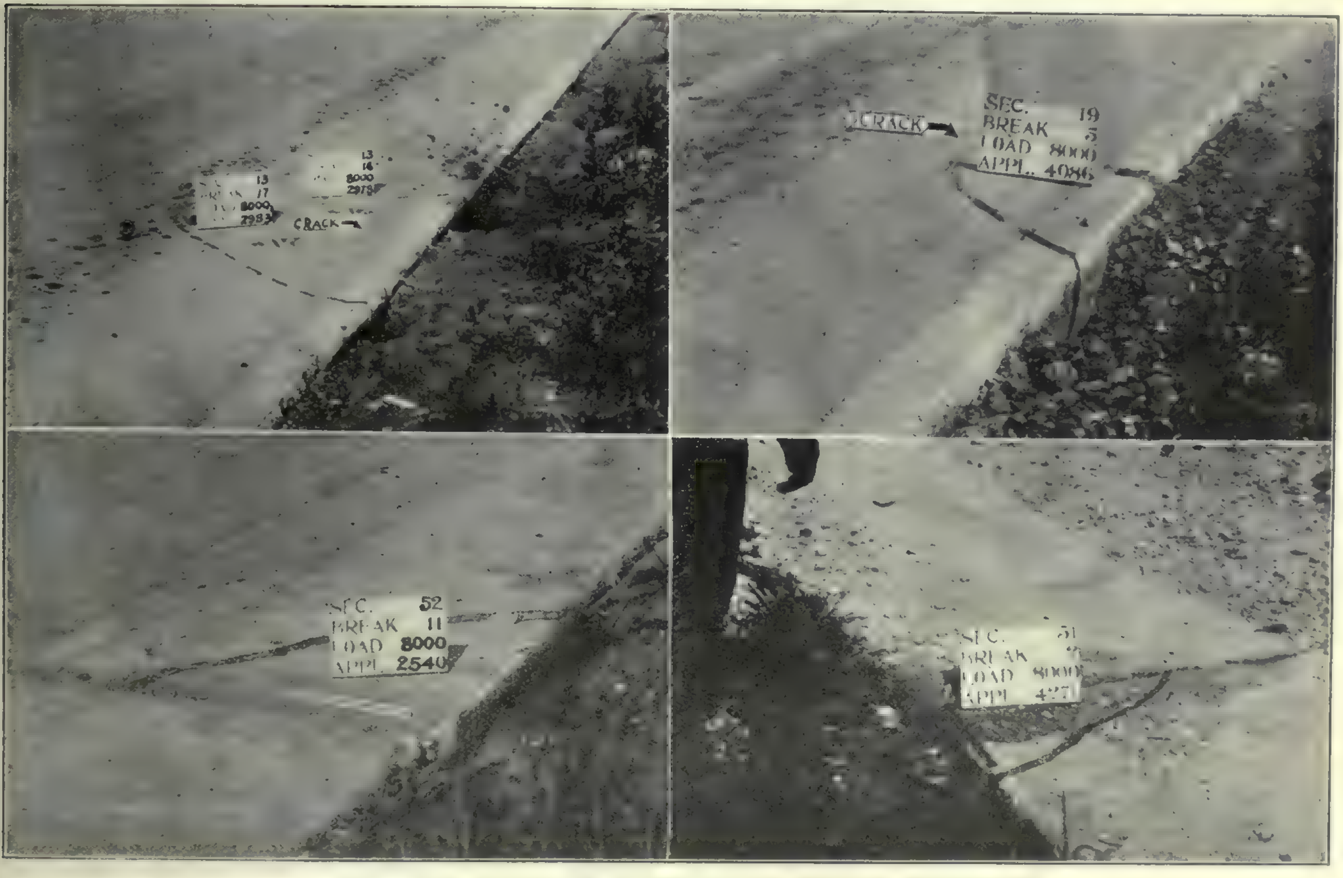
With knowledge of this kind as to the possible increase in strength and resistance to wear to be had through so simple a method as effective curing for so short a period as ten days, why should we throw away one-half of the life of concrete highways by failing to observe this rule.

Sixth Test on Bates Experimental Road

Illinois Division of Highways Announces Results of Run on August 11

Completion of the day runs of the sixth increment of load to be applied on the Bates Experimental Road was made on August 11th. The load used in this run was 8000 lb. on each rear wheel, this being the maximum load per wheel allowed on state roads in Illinois. Paving brick held in place in the boxes of the trucks produces the required load on the rear wheels. The load on each of the front wheels during this run was 1930 lb., an increase of 130 lb. over the load during the last run. The load as applied corresponded to 800 lb. per in. of nominal width of rear tire, and 386 lb. per in. of width of front tire.

Exactly 5000 applications of this load were imposed upon the surviving sections. Six sections (Nos. 6, 7, 8, 9, 10 and 11) consisting of asphalt top on macadam bases of various thicknesses, received only 3000 applications of the load of 8000 lb. At the end of this number of applications the sections were rapidly breaking up and it was thought that continued applications would destroy the sections to such an extent that visitors could not distinguish the action of the previous traffic. When traffic on these sections was suspended a turn-around was constructed on section 11 and the first eleven sections left undisturbed.



Typical Breaks In Sections Which Failed Under Sixth Increment

Complete failures in many of the sections involved constant heavy maintenance in order that traffic might continue. Practically half of the time during this run, it was necessary to suspend traffic on account of the difficulty encountered in maintaining the broken down sections; of the 37 days which elapsed from the beginning of the run to its completion, 17 days were spent on maintenance. Over 15 cars of materials were used in maintaining sections during this run.

The poor condition of some of the sections over which the trucks had to pass to reach the sections that had not broken down, was responsible for considerable damage to the tires of the trucks and necessitated a complete change in these tires. Though the trucks were carrying over 150 per cent. overload no engine or mechanical trouble of serious nature was experienced. This fact is nothing short of marvelous when it is considered that some of the ruts in the sections were well over a foot deep and the roughest sort of path was present.

A survey of the sections at the end of the day run of this increment of load shows only 11 sections of the 63 undamaged by traffic. Of these 11 sections, one consists of asphalt top on concrete base, one of bituminous filled brick on concrete base, and the other nine of concrete of various thicknesses and designs. In almost every section where failure is present, the breaks took place at the cut joints, progressive breaking developing from the original failure. As the bituminous brick sections contained both the lug and lugless brick, and as it was thought unadvisable to cut more than one joint in any sections, it so happened that the joints were cut in that half of the section containing the lug brick. Therefore though the greater number of failures took place in the lug brick it cannot be said that the lug brick is weaker than the lugless as no cut joints were present in the latter.

Of the sections remaining intact, sections 48 and 49 are the most surprising. These sections are composed of five inch concrete of special design. A 6-in. pavement of the same design as section 48 failed under an earlier loading. The reason for this apparent inconsistency of behavior is being investigated. The action of these sections under the night traffic will be of especial interest as less support from the subgrade will be given the edges at that time.

Though some of the lighter sections are still intact, it is not an indication that these sections show sufficient strength to carry the maximum load throughout the year. During the month of July when the day run of the legal load was applied the moisture content of the subgrade was lower than at any other time of the year. As the tensile fibre stress of a five inch rigid type pavement is approximately 700 lb. per sq. in. under a load of 8000 lb applied 6 in. from the corner, considering the corners as unsupported cantilevers, it is evident then that some support was given the sections at that time. If this load had been applied in the early spring when the moisture content of the subgrade was high and no practical support was afforded by the subgrade, it is probable that failure would have taken place. The night run now started is expected to increase the probability of the failure of these sections.

Under the load of 8000 lb. a total of 75 breaks occurred. Of this number, 60 were present in the south side of the pavement and 15 on the north side. This again illustrates the fact that if the traffic can be held away from the edge less failures will occur. At the end of the day run of this load, the road had been subjected to a tonnage of 51,600.

Night traffic on the road is now taking place. The load of 8000 lb. per rear wheel is being used in the night runs and the same number of applications will be completed as were imposed during the day runs with this load. It is expected that a great many more breaks will develop under the night loading than under the day runs due to the fact that less support is given the corners of the pavements at night.

Due to the great number of sections that are already destroyed it is possible that two series of trucks will be run to avoid traveling over the broken down sections. Nothing as yet has been decided in regard to running an overload on the road. It is possible, however, that the completion of the 5000 night applications of the 8000 lb. load will conclude the traffic runs on the road for the present at least.

Plans for building a few more sections of special design to be tested during the most unfavorable conditions, which occur during the late fall and spring, are being seriously considered.

Mechanical Equipment of a Highway Department*

By ALFRED DRYLAND

County Engineer, Middlesex.

Applying the underlying principles of our general experience to the highway side of our activities, as the requirements of modern civilization render good roads and cheap transport a growing necessity, so our methods must be speeded up and rendered more scientifically perfect by the use of machinery which will enable our side of the transport organization to keep pace with the vehicle development. The more our roads become the medium of transport the more it will be realized what bad surfaces mean in extra cost of haulage, and the more also will be appreciated what delay of traffic involves in expense to the community. The necessity must arise for the speeding up of all operations of construction and repair, so that the highways may be kept free to the utmost possible extent for convenient and speedy transport operations.

The tendency of modern road construction undoubtedly is towards the elimination of waterbound roads and the substitution of either tar-macadam or asphalt. There are certain firms which supply and lay these materials with satisfactory results, and having regard to the increasing demands, doubtless, these firms will both increase in number and in output capacity. Nevertheless, no large highway organization can be deemed to be fully equipped unless it has plant sufficient to meet a large measure of its requirements in these respects, and even the smaller authorities, so soon as their areas contain any large proportion of these surfaces, should be sufficiently equipped to carry out maintenance repairs.

Dealing first with cases where tar-macadam only is required, and taking as a basis county councils and the large towns, the following points must be considered.

The first is, convenience of obtaining materials, and secondly, suitability of site for distribution over the area to be covered. Where stone is used from a quarry, or slag from a works or "dump," that is obviously the spot for treatment; but if material has to be obtained from various outside sources, then railway or water carriage is a governing factor. If a railway siding is available, it is a great asset in reducing costs, and an ideal would be a siding at a high level to enable material to be delivered above the machinery.

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* Abstract of a paper presented at the annual meeting of the Institution of Municipal and County Engineers.

The kind of machinery required will depend upon the output required. Capacity of plant requires to be regulated by the number of laying gangs intended to be employed, as it will be found economical that the output should be sufficient to supply each gang with the amount of material they can properly lay in for a working day.

Every plant should be capable of drying as well as mixing, although it is not always essential that artificial heating should be used for tar-macadam, if the material be thoroughly dry. For a central plant on a large scale it is desirable that weather conditions should be defied and drying and mixing should therefore be under cover.

An overhead bin feed supplied through screens to different compartments is a very necessary adjunct to any large plant. A battery of bins, with a batch box suspended from a runway, travelling from bin to mixer, is a very convenient method, allowing of various sizes being separately treated, or being graded as desired.

For use beyond convenient distances from a distributing centre portable drying and heating plants are obviously most useful, but for permanent supplies from a centre, a properly equipped, fixed plant, rendered independent of weather conditions, is a great advantage.

The possession of plant places an authority in the position of being able to make use of a good deal of material which otherwise would be of small value. For instance, destructor clinker, sandstone, limestone, or even flint or gravel, can be turned into quite useful tar-macadam for light traffic roads and streets, and for base coats even in cases where a better material may be necessary for the wearing surfaces. Comparative independence of the manufacturer for supplies tends to prevent any undue inflation of prices and constitutes a valuable weapon of defence in these days of "rings" and "combines."

Asphalt Plant

Tar-macadam plant, such as before generally indicated, if of good type, can usually be adapted for the manufacture of base coats for sheet asphalt, but for wearing surface material higher temperatures are necessary, and the process of manufacturer requires more care, skill and scientific knowledge.

Where the requirements are for a large output, and the site is a good one for distribuiton over the required area, a fixed plant is desirable, because it can be so arranged as to allow of independence of weather conditions in manufacture. There are excellent movable plants on the market, capable of quite large outputs, but heavy rains, if only for short periods, are a serious disadvantage and involve much greater delays and expenditure of fuel than where all materials and plant are under cover. A heavy shower may cause no delay in the latter case, whereas it may spoil the rest of the day with an unprotected plant.

It is not proposed to describe in detail an asphalt plant as they should be designed, to some extent, to suit the circumstances of the individual installation, but the author suggests the following as the main desiderata. The heating apparatus should be capable of raising aggregates to a temperature of 500 deg. F., not that it is desirable to use it at so great a heat, but it is generally advantageous to store a portion of the output, as mixing is a more speedy process than heating, and an overhead hopper allows of accumulation of heated materials between arrival of vehicles. It is advantageous to have the bin or hopper divided into at least two compartments, to allow of grading mixtures, and a screen above the hoppers secures proper original grades. The efficiency of all bituminous pavements depends very largely upon the proper grading of its constituents, and too much care cannot be exercised in ensuring regularity.

An essential part of asphalt plant is a small laboratory fitted with instruments for testing the consistency of the matrix, and for analysis, and the necessary apparatus for testing the grading of the aggregate.

Asphalt Maintenance Plant

It has before been mentioned that it is desirable that small repairs at any rate should be capable of being executed locally. The plant required is not large or expensive, but must include a heater of the sand dryer for heating the mastic asphalt, a smaller boiler for the matrix, fire baskets on small wheels for burning off and drying the base for patches, and for heating the tools consisting of iron rakes, forks, shovels, and smoothing irons. For small patches the fire basket is quite sufficient, but for burning off considerable areas it always seems a slow and inexpensive process, and there is scope here for a useful invention. The author has only seen one asphalt firm equipped with an apparatus capable of preparing any considerable areas. This consists of a hood which is let down upon the surface, the heat being driven down by a blower from a coke furnace, and enables about 20 to 30 yd. per hour to be burnt off.

In the preparation of bituminous roads for re-surfacing it has occurred to the author that there is a useful field for the inventor in the direction of a machine for trimming the surface back to the plant. All know of roads which, while quite sound, are uneven, and with the present equipment cannot be satisfactorily surfaced without breaking up and reconsolidation. If a machine could be devised which could be adjusted to pick off all convexities so as to leave an even surface, it would be a money saver. Some gifted member with a mechanical mind may well devote himself to solving this problem.

There is a tendency at present to develop mastic asphalt pavements for which a combined cooker containing mixing apparatus, is used. This particular kind of work has, hitherto, apparently been entirely in the hands of private firms, but the same reasons as given hereinbefore make it desirable for small repairs to be carried out departmentally, and if the mastic is purchased, the plant required for patching would be quite small, consisting mainly of a portable cooking pot, the coarse aggregate being stirred into the mixture and the patch finished with a float.

There is a great variety of machines on the market for executing this very necessary operation, and no large highway department can be considered complete without sufficient plant of this character to enable it to execute a large proportion of its work within a reasonable period of time, having regard to the necessity of taking the utmost advantage of favorable weather. It is unnecessary to discuss in detail these machines, but generally the author is in favor of the simplest possible form of machine, and attaches no importance to velocity in the process of application, as he is convinced that it has no effect upon the efficiency of the coating. The main consideration in a machine is that it shall have sufficient heating capacity and admit of easy and regular application of the tar to the road surface without unnecessary mechanical complications.

The want of a serviceable mechanical means of applying grit to both tarred surfaces and to slippery roads has long been felt, and there are now on the market several makes of such a machine. For the purpose of tar dressing it is important that such a machine should have a front delivery so that the tar is not picked up by the wheels.

Haulage

An adequate outfit of mechanically-propelled wagons is a very necessary adjunct to any large highways department. The character of the vehicles depends largely upon the circumstances of the particular area to be served. For station haulage, a steam tractor and trucks is a very useful outfit, so that the tractor can spend its time in travel instead of waiting at either end for unloading purposes. For long journeys, where speed is necessary, and particularly for hot material, a steam or petrol wagon is preferable. Where speed is of particular importance, the petrol-driven wagon has the advantage. For short hauls the 1-ton type of vehicle has been found most useful. It is essential that all vehicles shall be of the tipping type; as to whether they shall be end or side tipping depends upon the nature of the work. For depot purposes, and for earth shifting, or supplies to concrete mixer, an installation of light-gage railway and tipping trucks is a desideratum. Where the distance hauled is appreciable small tractors form a cheap means of haulage for the light railway plant.

It is not necessary, or perhaps desirable, for a highway authority to provide itself with rollers for executing the whole of its annual program of work, because that may mean that some portion of the plant is frequently standing idle during the seasons which are not favorable for carrying out works of a particular kind, but all large highway authorities should have a roller equipment at least equal to 50 per cent of their total requirements, and this can probably be economically carried as high as 75 per cent. For water-bound material the ordinary steam roller still holds the field as the most efficient machine, but for laying plastic material, and particularly that generally laid hot, rollers of a smaller and lighter type, with a short wheel base and capacity for easy steering and turning, are very desirable, as or these plastic materials cross rolling is of importance in mitigating the tendency to initial transverse waves. A quick reverse is sometimes advocated, but a very easy reverse is the feature to be aimed at, so that there is no jerk in the reversing process, otherwise transverse depressions will be formed.

EXPANSION AND CONSTRUCTION JOINTS IN CONCRETE BRIDGES.

The distance apart of expansion joints in concrete construction, which are necessarily at closer intervals than would be necessary in steel structures of similar magnitude, depends upon the type of structure and no specific recommendations relatives thereto can be safely given by the committee.

Broadly speaking, there are three types of highway bridge design requiring expansion joints; first, the arch type, with superstructure composed of transverse or longitudinal walls supporting a floor syystem or with back fill of earth where the sidewalk construction is cantilivered from a parapet wall; second, the T-beam or rectangular slab design, supported on columns or bents; third, the multiple way reinforced flat slab structure on columns. The latter type has not been extensively used, but there is a wide field for its application.

In the development of expansion joint details, the following considerations should be borne in mind. In the arch type, with superstructure, expansion joints in the superstructure must provide for movement in both a vertical and horizontal direction—up and down for rise and fall of the arch ring and in a horizontal direction due to elemental changes of length in the various members of the floor system.

Where transition for these non-concurrent movements from one section to another is attempted in the superstructure by sliding or vertical surfaces in contact, there is the imminent danger of a shearing failure in these sections in contact, caused by excess of frictional or tortional action over the strength of the section in shear.

Joints placed at the quarter points of the span, approximately at the point of contraflexure in the arch ring, and at the pilasters adjacent to the piers, have proved successful for spans of 90 ft. to 200 ft. This arrangement divides the floor system over each arch in three sections, and eliminates an extremely large moment in the floor system over the haunch of the arch, due to a maximum vertical movement at crown of arch. The amount of moment or tension in the floor system due to vertical movement of the main arch ring varies with the

(*Concluded on page* 72)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. L. POWERS
Editor

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

Vol. LXIII August 23, 1922 Number 8

CO-OPERATION

The Federal Aid Highway Act of 1921, which requires the states to expend federal aid funds on a connected system of highways designed to serve the needs of the entire country, has been the means of bringing about recently two important conferences. The first of these was a meeting of the highway officials of the New England states with the engineers of the U. S. Bureau of Public Roads. Its purpose was to lay out a system of federal aid highways for New England. It is the first meeting of its kind ever held for the purpose of extending highway system beyond the limits of any single state.

The other conference was a first meeting of the Committee on Tests of the American Society of State Highways Officials and the engineers of the U. S. Bureau of Public Roads. The object of this meeting was to establish standard specifications and tests for highway materials.

In both of these conferences a single idea was dominate—cooperation for the betterment of all. May the work thus started continue to spread.

HIGHWAY FINANCE

"Plan now the financing of highways for the future and place highway transportation, which has come to be an indispensable part of our national life, on a firm foundation." This is the advise given by Thomas H. McDonald, chief of the Bureau of Public Roads, United States Department of Agriculture, for the consideration of every voter, tax payer, and legislator.

"We are starting out to construct a system of highways such as no nation ever constructed before. The nearest approach to it is found in France and Germany, and the area of neither is as large as Texas. This great undertaking is being entered into because highways are not a luxury but furnish a real service, have a real earning capacity, and have become a national necessity.

"For such an undertaking to be successful, financing to care for maintenance, reconstruction, and new construction should be planned for a long period of years in advance. Changes in methods of raising funds every few years, uncertainty as to whether funds will be provided and periods in which funds are not provided all increase the final cost of highways. Such a policy would soon bring any private business to disaster.

FOREIGN INTEREST IN AMERICAN ROADS

Many foreign countries, particularly those of South America, Japan, South China and Australia, are much interested in American methods of road construction.

In recent months various state commissions have been visited by several Japanese and Chinese engineers sent to this country to study the operation of the federal and state highway organizations and to inspect actual construction.

The Australian government proposes to be careful in adopting a road-making program and D. V. Fleming, engineer of roads and bridges for South Australia, is in this country, studying types of roads. Mr. Fleming states that the road question is coming to the front in Australia because of the development of automobile traffic. There are very few hard-surfaced roads in Australia, although there are some wood block roads which are very good, he states, due to a particularly hard wood used.

ROADSIDE WEEDS

The building of modern concrete highways is often accompanied by a desecration of trees and shrubs that leaves a scar upon the motorist's landscape, which Nature cannot hide for many years, declares a writer in a recent issue of the *American Motorist*. In the construction of such roads it is not unusual to wholly clear the right of way between abutting property of all trees and bushes. Because of this, innumerable attractive native shrubs are destroyed, shrubs that never will be replaced and the lack of whose bright blossoms and colored berries will be sadly missed by those who find pleasure in such things. The same is true of wild flowers. Where the right of way is graded and worked by road-building machinery a surface is left in which nothing but weeds, as a rule, can secure a foothold. Probably this cannot be wholly overcome in modern road building, but if the State forester were permitter some oversight in matters of this sort it is possible that many of the more attractive trees and shrubs so ruthlessly sacrificed in such instances might be saved.

U. S. SPENDS 600 MILLION FOR ROADS IN 1921

A total of $600,000,000 was spent for construction and maintenance of highways in the United States during 1921, according to figures compiled by the Bureau of Public Works, U. S. Department of Agriculture.

Of this sum local road bond issues accounted for 33 per cent of the total. Motor vehicle revenue added 19 per cent more. The U. S. Government, under the Federal Aid Act, gave 14 per cent, while county, township and district taxes and assessments secured an equal amount. State taxes and appropriations added 12 per cent, while state road bonds amounted to 7 per cent of the total.

It is interesting to note the position of state road bonds in the table. A vast amount of publicity was given to the state bond issues, and yet they totaled only 7 per cent of the money spent in 1921.

EXPERIMENTAL TESTS TO BE MADE ON OILED ROADS

Arrangements have recently been made by the University of Illinois for the construction of a 12-mile experimental oiled road upon which tests will be made to determine the relative merits of different kinds of road oils; the best method of applying the oil; the annual cost per mile of a well-maintained oiled road; and the number of days per year that an oiled road may be expected to be in good condition.

The experimental work will be under the supervision of Prof. W. M. Wilson and Prof. C. C. Wiley, representing the university, and R. F. Fisher, county superintendent of Champaign County.

AGREEMENT REACHED ON NEVADA FOREST HIGHWAY PROGRAM

At a conference held in Reno on August 1 between the State Highway Engineer and representatives of the U. S. Forest Service and the Bureau of Public Roads an agreement was reached regarding the various projects within the State of Nevada which are to receive allotments under the Forest Highway Program. Previous to this conference this Department had filed a request that Forest Funds be allotted on the following projects:

Austin Summit Road, Lander County........	$10,000
Elkhorn Summit Road, Lander County......	96,000
Illipah Summit Road, White Pine County....	60,000
Currant Creek Road, White Pine & Nye Counties	53,400

In the agreement reached on August 1 the Department has withdrawn the requests on the above projects and has agreed to file requests and place on the program the following projects: For the construction of a project in Lander County, extending from the east end of the completed Austin Summit Project, a distance of fifteen miles east or approximately to the Eureka county-line, funds set aside, $115,000; For the construction of the Currant Creek project in Nye and White Pine Counties on the Ely-Tonopah road, funds set aside, $68,000; For the survey of the Elkhorn Pass section in Lander County it was agreed that an allotment of $5,000 would be made.

The above agreement represents the Forest Highway Program outlined for the present fiscal year. In addition it was agreed that from the funds available next year there would be set aside a sufficient amount to take care of the construction of the Elkhorn Pass section or a section of like length between Austin and the west Lander county-line.

GEORGIA ASKED TO SPEND $75,000,000 FOR ROADS

Good roads enthusiasts in Georgia are boosting a campaign for a $75,000,000 bond issue which will be used to construct 5500 mi. of a county-seat-to-county-seat State system of roads in the next 10 years.

A Leaflet entitled "Lift Georgia Out of the Mud," advocating the bond issue, which will be retired through the automobile and gasoline tax, carries the following statement: "With the bond issue, Georgia will be in a position to do in 10 years what it would be impossible to do in 30 years without the bonds. At no time during the life of the bonds, is there a period when there is not a balance for maintaining state roads."

Another piece of literature entitled "Georgia Good Roads Primer," put out by the Georgia Good Roads Association, takes up the problem and its solution in a well presented Question and Answer treatise.

HIGHWAY WORK IN MINNESOTA DURING 1921

Minnesota highway work during 1921 benefited 3,393 miles of main routes, while patrol and maintenance service was given on 6,885 mi. of the 7,000-mile system of state trunk highways, 765 mi. of grading and 497 mi. of gravel-surfacing were added to the respective 1,499 and 1,371 mi. total listed as graded and gravelled when the state took over the trunk routes for improvement and perpetual upkeep. In addition, state maintenance forces re-shaped 1,137 mi. and re-surfaced 885 mi. on the trunk system. The Minnesota Highway Department last year planned and supervised projects representing an outlay of $19,321,238.60.

HIGHWAY RESEARCH SPECIALIST WANTED

The United States Civil Service Commission announces a competitive examination for Highway Research Specialist, receipt of applications to close September 12. Grade I receives salaries of $1,800 to $3,000 a year, or $6.00 to $10.00 a day, and grade II receives $3,000 to $4,500 a year, or $10.00 to $12.50 a day. Applicants must have had at least 6 years' preliminary training in civil, structural, mechanical, electrical or chemical engineering, each completed year of an engineering course being considered equivalent to not more than 18 months of experience. They must also have had at least 3 years' practical experience, of which at least one shall have been in the direction or performance of investigational work.

PENNSYLVANIA BUILDS 225 MILES OF ROADS IN 1921

During the present construction season the Pennsylvania State Highway Department has put down 224.6 mi. of durable highway. This mileage is less than that constructed during the same period in 1921, due to the fact that not so many contracts are in force and also to the effect of the coal and railroad strikes.

During the latter part of July the coal situation began to interfere with the output of the mills supplying cement to the nearly 200 conractors at work on Pennsylvania roads. Now that a settlement of the mine difficulties has been reached this situation promises to clear up. The car question is still, however, a serious one, and the reopening of the mines will cause a great demand for hopper-bottom steel cars, which are necessary to road contractors because of sand and stone shipments. It is the hope of the Highway Department that it will be possible to secure the cars necessary, inasmuch as a large number of road sections are being completed which will tie in already-built roadways of benefit to the state at large. This is particularly true of the main north-south, east-west and diagonal roads on which the major portion of the improvement has been completed and which the Department hoped could be completed in 1922 in their entirety.

CALIFORNIA TO PLANT TREES ALONG ITS HIGHWAYS

The State Highway Commission of California has recently granted permission to the Chamber of Commerce of Willows, to plant 500 black walnut trees north along the west side of Sacramento Valley state highway. South of Willows 50 trees of different kinds will be planted to demonstrate alkali resistant qualities.

The Board of Supervisors of Yolo County have been granted permission to plant coast oak, black walnut and Lombardy poplar trees along the State highways in that country.

CEMENT INDUSTRY AT MERCY OF COAL SUPPLY

Few industries are so at the mercy of fuel supply as is the cement industry. Coal is the fuel most used. A white-hot flame, producing a heat of from 2500 to 3000 deg. F. is required to burn the raw materials into glass hard clinkers. The gigantic rotary kilns in which the burning is done have an unending appetite for coal. Coal must also be used to produce the large amount of power required to grind the raw materials before they are burned, and again to grind the hard burned clinkers into finished cement.

In times like the present with a coal crisis confronting every individual in the country, the seriousness of such a situation can be better realized. If obtainable at all, cement companies must not only pay several dollars more per ton for the coal itself, but must get their supply of coal from more distant fields with sometimes more than $1 per ton increase in freight.

The cement industry is the fourth largest consumer of coal and the largest user of pulverized coal in the United States 7,400,000 tons of bituminous coal being required by the cement industry in 1921 to produce that year's output. In addition, plants using fuel other than coal consumed more than 2,300,000 barrels of crude oil and over 3,000,000,000 cubic feet of natural gas for power and cement burning.

Cement manufacturing is one of the great and growing industries of the country—employing a large amount of labor in its manufacture and use—influencing by its purchases of coal, machinery and other materials, the employment of thousands of American workmen in all branches of industry.

A UNIQUE FEAT IN BRIDGE BUILDING

Lengthening a bridge 70 ft. by adding a steel span procured 60 miles distant, persuading the contractor of a dredging project to dismantle his machine in preference to tearing down the bridge under which it would not pass, all accomplished at a saving of $33,000 over the cost of a new bridge equally as good, is a unique feat in bridge engineering in the state highway department in Indiana.

This bridge rebuilt through modern engineering methods, spans the Muskatatuck river at Milport, halfway between Seymour and Salem. Flood waters of several seasons showed the river was too narrow, so county commissioners contracted to widen the stream by dredging. The highway commission negotiated with the contractor to dismantle his dredger, and the departmemnt removed the dirt within the state's right-of-way. The bridge was lengthened—an action necessitated by widening the stream—by adding a span taken off a bridge on another state road near Southport.

The Milport bridge is near the famous Milport Knobs, immediately south of the river on the Salem road. This old road is identified with the history of this section when Indiana was a part of the Northwest Territory. The road is said to have been laid out by French military engineers. The old bridge was built in 1884, and while in fairly good state of preservation, it would not have been practical to have re-erected it had it been necessary to raze it to permit the dredger to pass.

In making this bridge capable of meeting traffic requirements for several years, a new floor was laid, steel work cleaned and painted, and the contractor tightened the truss members in a most ingenious manner. A forge was placed at the center of the rods, the steel heated to proper temper, and forced together by driving the rods from either end. The old stone abutment was removed and a new concrete pier and abutment laid to care for the additional span. The old abutment rested on hewed logs floating on soft clay, engineers say. The new concrete pier and abutment were placed on 35-ft. piling driven to solid rock approximately 50 ft. below water level.

EXPANSION AND CONSTRUCTION JOINTS IN CONCRETE BRIDGES

(*Continued from Page 63*)

ratio of rise to span; the flat segmental arch causes greater moment than the semi-circular arch of equal span. The principle or effect of the cantilever joint in floor system can be secured in the parapet wall construction of a barrel arch supporting earth fill, by vertical joint through the walls and sidewalk.

For the second type, the T-beam or rectangular slab desgn supported on columns or bents, the action to be controlled is in the horizontal direction only. In the T-beam type there arises the difficulty of transferring the movement due to temperature changes from the larger through the smaller members as from the deep beams through the slabs. Regardless of the length of structure, the slab should be substantially reinforced in transverse direction to distribute stress or prevent a cumulative strain at change of sections.

The ratio of span length to height of columns or bents should be taken into consideration.

For sliding joints, plates of steel, copper, zinc, or lead, and multiple layers of fabrics or combination of these different plates have been used to reduce friction resistance. Where the bearing covers a wide area there is the danger, if heavy plates are not used, that the sliding medium or plate will conform to a possible uneven surface of a bridge seat and cause a crack. Therefore, great care must be exercised in preparation of the sliding joint or bridge seat, as it is generally called.

The third type, the flat-slab construction, can be built in greater lengths between expansion joints than either of the preceding types. Because of the uniform cross section everywhere of both concrete and steel, the slab offers better resistance to temperature changes, the movement being distributed more uniformly throughout its entire length. Expansion joints in this construction are formed by double row of columns, and in good practice the joints should be spaced at distances not exceeding 250 ft.

Construction Joints

The location of construction joints should be shown on the plans, since this detail is a decided help to the contractor in his analysis of the construction problems. The designer should bear in mind the capacity of plant commensurate with the magnitude of the work.

The lengths of reinforcing rods should be predetermined, so that no excessive lengths of rods project beyond the construction joint. The rods should project beyond the bulkhead forming the construction joint far enough to develop bond strength with the next lift of bars. In beam or slab construction, the point is placed at point of at least shear, or maximum moment, and no lap of bars should be made at this point.

Gravity walls should be built in one operation from footing course to the underside of the coping. Construction joints should be placed at intervals not greater than 30 ft. By addition of temperature steel, sections can be increased to 50 ft. in length. Vertical joints are more desirable than horizontal joints, which tend to become unsightly cracks, due to the resulting efflorescence and gradual disintegration at the joint. Dovetailing adjoining sections and placing copper flashing in the joint are added precautions tending to seal the joint against percolation of drainage water. Construction joints should be avoided along any plain in the structure.

PERSONAL MENTION

H. W. Phillips has been appointed superintendent of construction for the city of Davenport, Iowa.

L. M. Weisiger, engineer of the South Carolina State Highway Department, has resigned to accept a position with J. M. Gregory of Newton, N. C.

Charles A. Patterson, borough engineer of Torrington, Conn., has resigned to become the chief engineer of the contracting firm of Mascetti & Holley of Torrington.

Clayton E. Swain, superintendent of public works, Rockville, Conn., has resigned, and is now associated with the U. S. Bureau of Public Roads.

William F. Strouse has resigned as chief engineer of the Public Service Commission of Maryland and will be succeeded by H. Carl Wolf, now engineer of public utilities for the commission. Mr. Strouse, as valuation engineer, will continue to be a member of the commission's engineering staff.

Major L. D. Blauvelt has resigned as state highway engineer of Colorado, to become chief construction engineer for the Moffat Tunnel Commission, Denver, Colorado.

R. E. Kelley, of Willamantic, Conn., has been appointed an engineer of bridge construction for the Maine State Highway Department.

Edwin J. King, for five years county engineer of Sabette Co., Kansas, has been appointed Kansas representatives of the Portland Cement Association to succeed Frank Altman.

H. L. Seventon has resigned as assistant engineer with the California State Highway Commission and will be employed as engineer with the Western State Power & Electric Co.

Alexander W. Graham, former Missouri State Highway Engineer; Alfred T. Brown, formerly with the Highway Culvert Company of St. Louis; and Frank J. Beard, formerly Engineer of Survey and Plans, Missouri State Highway Department, announce the incorporation of the Highway Equipment and Material Company with offices in Jefferson City, Mo.

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Vol. LXIII August 30, 1922 Number 9

TABLE OF CONTENTS

The Maintenance of Macadam Roads 73
By W. A. Van Duzer

The Development of Permanent Highways . . . 75
By John P. Hartman

The Federal Aid Act and State Financing 78
By R. M. Hubbard

EDITORIALS AND NEWS:

Six Months Progress 79
Effect of Organic Matter in Concrete to be Studied 79
Minnesota Makes Favorable Showing in Government Figures on Federal Aid 79
I. C. C. Allows Lower Rate on Road Building Material 79
Massachusetts Gathers Figures on Motor Vehicle Roads 80
Road Building in Indiana 80
Moving Pictures to Show Various Types of Highways 81
Missouri to Spend Ten Million Dollars on New Roads 81
Flood Emergency Met by Federal Aid Road . 81

Meetings 81

Personals 82

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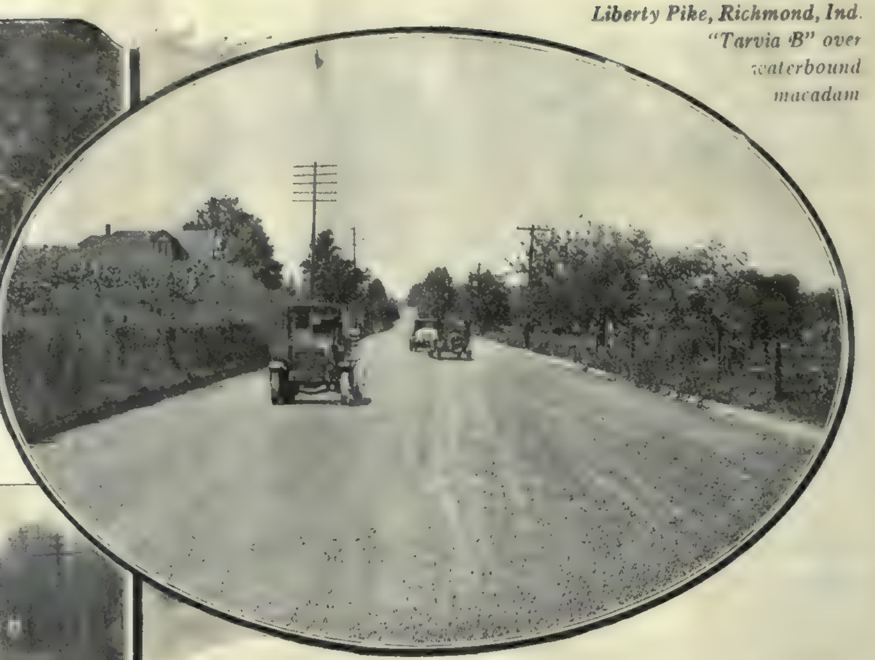
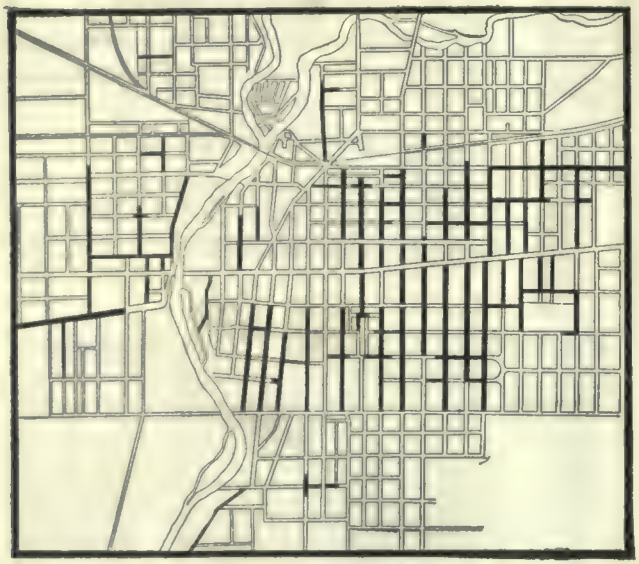
North 15th Street, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Liberty Pike, Richmond, Ind. "Tarvia B" over waterbound macadam

Chester Pike, Richmond, Ind.—Macadam maintained with "Tarvia-B"



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GOOD ROADS

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WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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The Maintenance of Macadam Roads

By W. A. VAN DUZER

Assistant Maintenance Engineer, Pennsylvania State Highway Department

Several of the states, particularly those in the East, have large mileage of stone and macadam highways, and previous to the advent of the automobile such roads answered every purpose. With the intensive auto traffic and general adoption of the motor truck for local and long distance hauling, however, road authorities were confronted with the immediate necessity of building roads or repairing those already in existence to meet these modern traffic conditions.

It was early seen that with the methods employed, the construction of the old type of waterbound macadam was obsolete, but with the perfecting of scarifiers, stone crushers, and other modern road building equipment, it became possible to improve the large mileage of stone roads in such a manner that, with but very few exceptions, they have stood up remarkably well. This success ras been possible by early determining to use *large stone* macadam, thoroughly bonded and cured and preserved by a consistent policy of surface treatment. In this paper we will discuss only the special points which enter into the economical maintenance of tthe waterbound macadam type of pavement.

Resurfacing

The following actual operations enter into the resurfacing of a macadam road: The preparation of the base, which includes: rebuilding of weak spots; subdraining springs or spongy places; grading to take out depressions; and scarifying to form a uniform cross section, so that an even depth of ballast can be spread. One of the most important points in this preparatory work is to have all pipes and drainage structures placed in advance of actual resurfacing so that the necessary back fill will have had time to settle.

The ballast used in Pennsylvania must meet the following requirements: It must consist of clean, tough, durable crushed rock, with a French coefficient of not less than 10 and shall be uniformly graded and of such size that it will pass over a screen having circular openings of not less than 1½ in., and through a screen with circular openings not more than 3½ in. in diameter, our preference being to use as large a size as possible depending upon the finished depth of surface to be laid.

The screenings shall consist of material prepared by crushing rock of approved cementing quality, free from dirt and other foreign substances. It has been our experience that screenings with a large percentage of dust, give better results, in that the voids are better filled, and the tendency to ravel before surface treatment is considerably lessened. The chips fill the top voids and prevent the dust from going to the bottom with a consequent loosening under traffic.

The Common Method

The general practice is to place the ballast ahead of the section where it is to be eventually used. The screenings are dumped to the side on the previously prepared shoulder. The finished work more than justifies this additional expense. Some success has been obtained by special spreading devices used in connection with dump trucks.

The ballast is thoroughly dry rolled with a 3-wheel 10-ton power roller until the stone does not creep or wave under the action of the roller. The screenings should then be spread fan-wise from a shovel and thoroughly broomed into the voids in the stone, the rolling to continue from the sides toward the center until all voids are thoroughly filled, but no appreciable mat formed. The water is then applied ahead of the roller and the rolling continued until a grout is formed. This grout flushes to the top, and is evenly spread over the roadway by the action of the roller. While it is not absolutely necessary, we believe it is better if the road is allowed to dry before being thrown open to traffic.

We have tried to cover the materials and methods used in the construction of a first class macadam road, inasmuch as economical maintenance can be built into a highway by the exercise of judgment. This judgment is based on experience as to what will give longest life in connection with subsequent maintenance, which consists, to a great extent, of proper surface treatment and intelligent and careful patching.

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* Abstract of paper presented at 1922 Convention of the New Jersey Highway Association.

Before the application of the surface treatment a macadam road should be cured by the action of traffic for at least two months. The maintenance during this time consists principally of sweeping, either by caretakers, or lightly by mechanical broom of horse-drawn sweeper. This sweeping is done for a dual purpose: First to remove the cake or matted screenings from the edges. This we deem is extremely important, and unless care is used will necessitate extra treatments. Second to place these screenings in the center of the highway, where they have been removed by the action of traffic. The screenings which are swept back to the center will prevent the road from ravelling and assist in curing it. Under exceptionaly heavy traffic it is found necessary to add dry screenings and occasionally during hot dry spells the sprinkler can be used to advantage both in holding the road and assisting in the curing action. But, under no circumstances should a road which is not broken up be re-rolled, as this breaks the bond and destroys the value of traffic curing action.

Surface Treatment

Previous to the first application of bituminous material, which we believe should consist of a low viscosity tar, in order that a maximum penetration can be obtained, the screenings must be removed by sweeping so that the voids will show between the ballast to a depth of possibly ¼ in. The tar should be applied in two treatments by a pressure distributor, if possible, or other mechanical means. The first application to be approximately 1-3 gal. per sq. yd., and the second from 2-10 to ¼ gal. per sq. yd. Our experience has been that a third of a gallon applied will penetrate the road. The second application will heal up the spots that are not thoroughly bonded or are loosely bonded, but will not fill the voids, and leaves the ballast to take the wear with the tar as a binder. The second application may be either a high viscosity tar or asphalt and the quantity should be just enough to fill the voids, which can only be determined from experience, but usually runs from 0.25 to 0.3 gal. per sq. yd. On a road that carries extremely heavy traffic we occasionally skid chip it on the first application, that is apply from 3 to 10 lb. of chips to the square yard as a safety measure, particularly on heavy grades and narrow roads.

Hard stone chips ranging in size from ¼ in. to 1 in. in size, dustless, and free from dirt, should be used with the second treatment, at the rate of 20 to 30 lb. of chips per square yard or approximately one cubic foot of stone chips to one gallon of bituminous material. Owing to the large chips used and to assist in pushing the chips into the bituminous material, the treatment should be rolled either with a 5 to 8 ton tandem or 10 ton macadam roller. The roller can be used as soon as the chipping is completed, but equally good results are obtained if the road is rolled 24 to 36 hrs. later, if a rapid drying bituminous material is not used.

We have obtained the best results by three successive treatments. The third treatment may be either a high viscosity cold tar, water gas or asphalt, or as an alternative a hot asphalt having an asphaltic content of 88 to 95 at 100 penetration, or a consistency (float test) of approximately 0.15 to 0.25 gal. per sq. yd., which requires from 30 to 40 lb. per sq. yd. of covering material. This treatment must be watched carefully, as the roadway will bleed after it is thrown open for traffic, and, if not given proper care by application of chips, will pick up badly under steel tire wagon traffic. If the treatment is made late in the fall it may require rechipping after the beginning of hot weather in the spring.

Maintenance of Macadam

The necessity for uniform continuous maintenance is probably greater for the waterbound macadam type of construction than for any other. The advantage of thoroughly experienced workmen is unquestioned and considerable care must be exercised in picking the organization and seeing that proper instructions are issued covering each phase of the maintenance work.

There are two general systems recommended for carrying on the maintenance of these roads, both of which have their advantages. They are the caretaker or patrolman, and the patrol crew or gang. The first is closer to the ideal if properly controlled. This plan arranges the road mileage in sections fromm 3 to 5 mi. in length, with a patrolman, properly provided with tools, materials, etc., whose duty it is to keep up the small repairs and emergency work, and with authority to hire additional men, teams, etc., when instructed by their immediate superior. These caretakers keep the surface patched and all depressions filled; see that the side gutters and cross drains are kept open; paint slight surface depressions and sprinkle with chips tamped in place; larger depressions are filled with larger stone and topped with patching tar and chips, the mix being in a proportion of 1 to 12, or 1 to 14, depending to some extent upon the weather. In case of failures due to stopped drains or springs the whole section is dug out and drainage placed leading to the gutter or culvert and large stone laid to bring up the base. The ballast and screenings are hand tamped in place if no roller is available and the spot painted and given a mixed patch of tar and chips.

The Patrol System

The patrol gang is an organized force of picked men, provided with tools, materials, etc., to maintain road mileage of various lengths. As far as overhead expenses are concerned it is possibly more economical than the caretaker system, the men being well trained and efficient for each class of repair work. The difficulty, however, is that a force of this kind cannot give each section the required attention, especially in emergency cases. The work cannot be accomplished simultaneously as in the caretaker system, which we deem is the real factor to be desired. The gang system, is, however, an insurance

(*Concluded on Page* 82)

The Development of Permanent Highways

By JOHN P. HARTMAN

The subject of permanent highways, is a very broad and and admits of a discussion which cannot be covered in a single address. Let us confine ourselves, therefore, today to the subject of the building of highways of proper gradient, say, not exceeding 5 per cent. in any place, low in curvature and the placing of surfacing of a character that will be as nearly permanent and indestructible as is possible to obtain and necessity therefor. True this is a large undertaking, but our business and economic necessity demand this course and type. Fundamental requirements demand such roads.

The Farmer and His Interest

On this continent fully 80 per cent. of all our real production comes from the soil. Therefore the farmer and the farmer's interests ought to be and latterly have become a problem paramount to all other business and enterprise. Finally, law makers, economists and captains of industry have all so concluded. Not so have we heretofore regarded the farm and the farmer, but today we find that the economics of the situation are such that our future depends upon the building up of the farms and the cheapening of production. For a long time farmers have been discouraged, could not foresee real success and then became pessimistic in many districts and places. Largely was this true because he was shut in, charged with unreasonable overhead expense to transport his product to the railroad and from then on was the victim of middlemen's trading pranks, and too frequently rascality, that often left no value for the producer. And we must admit that there was just ground for the farmers' pessimism.

The coming of the all year round passable highway, with free rural mail delivery, has put the farmer close to the market and with his daily papers, his daily market reports and his quick receipt of the best magazines and papers, he now has become one of the best posted classes in the whole country. He has more time for study, less allurements to take him away from his intellectual pursuits than the city man, and therefore as a class, is rapidly becoming the best posted among our people.

The Change in Power

Twenty-five years ago the railroad manager reached the zenith of his power and influence in both our countries and then became dominant, autocratic and often despotic. Because of this he fell and the management of his properties was taken out of his hands and turned over to government regulations. Next in line, was the rise of the labor organization manager. The banker's star is now near its zenith, but he is in great danger, if the course and policy are not changed, of sharing that which has been meted out to the railroad managers and the labor leaders.

All these could wield their power and reach their spheres of influence, because the real producers, the farmers, are remotely situated, unorganized and not able to control their own and that which they produced. The farmers condition, however, shall, must and will be changed speedily so he may have a real voice or Rome's fate will be ours.

It is the building of the better roads, enabling the farmer to better understand his relations and assert his rights, that has brought and will bring the four influences named above, to a sensible realization of their duty to all and particularly to the producer, so that instead of the farmer paying treble, for selling his product, as he has to he will be a partner with capital and labor and scrap by gradual degrees the leaches that have been allowed to control, fatten and exist, between the producer and the consumer and always at the producers' expense. Therefore the more attention we give to the development of proper roads, the sooner will the evolution be accomplished and upon accomplishment the evolution, conditions socially, commercially, politically and religiously will be wonderfully improved.

United States the Leader in Road Building

The figures show that no nation in the world, during modern times, has built so many miles of hard surfaced roads as the United States. The people have been most liberal in allowing, and in many cases demanding, heavy taxation besides voting large bond issues therefor. In many governmental divisions one-third of the general tax levied and collected is for roads, to which often bond issues are added. That is done because the man of his day wants the roads today and is willing to pay because he knows it is money spent that will bring good returns.

Mistakes and errors have been committed in many places in road building, but often it is through mistakes that we learn how to do things well. In one state, for instance, millions of dollars were raised by bonds and the amount put into hard surfaced roads or at least so-called hard surfacing. The material placed thereon did not stand the wear and tear of modern vehicular travel and quickly, in many places, it went to pieces. The upkeep became enormous. In some instances it was as high as $1,100 per mile per year, and rarely less than $300 per mile. This cost is prohibitive for the road would be gone entirely, long before the bonds matured. In one instance a stretch of road was built costing about $102,000 and within two years it had so deteriorated that

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Abstract of an address delivered before the National Good Roads Association of Canada, at Victoria, B. C., June, 1922. Mr. Hartman has been a promotor of good roads building in the United States for twenty-five years past and several years President of the Washington Good Roads Association.

bids were called for to make the road good. The lowest bid was $118,000 or $16,000 more than the original cost of the road. This would be a comedy if it were not so tragic.

One county in Washington made a heavy bond issue and constructed Portland cement concrete surfaced roads to the extent of about 130 miles. They have been in use nearly ten years. The upkeep on these roads averaged less than $5 per mile per annum (a negligible sum) and possibly this would have been lower but for the excessively heavy haulage, consisting of saw logs, breaking some of the corner slabs, the loads being up to 60,000 lb. upon the gasoline driven trucks.

A district in Michigan using the same surfacing has had an experience of more than 15 years. These roads have cost in upkeep less than $100 per mile. That, however, does not apply to their first construction because the plan and way of building was defective, as was shown by experience, but after about three years, they learned better and finally 90 per cent. of their roads have stood the test and the others would have stood the test but for want of proper knowledge in construction. Roads costing for maintenance, not to exceed $100 per mile per annum may well be called permanent so far as surfacing is concerned.

The Permanent Road

It has been generally conceded by road builders and engineers, that the only lasting surface and surfacing is Portland cement concrete or brick laid upon concrete or brick laid upon concrete base. The brick surfaced roads are first class, but cost nearly twice as much as the concrete alone, while the brick do not sustain any weight, but only provide a wearing surface. Therefore, it has seemed poor business to use the equivalent in concrete for base, as in a strictly concrete road, and lay the brick thereon, when by omitting the brick twice as much road may be obtained and when done is as good without the brick as with them.

One direct reference is important. The Lincoln Highway is the great road from New York to San Francisco, a distance of 3,300 miles, of which fully 1,200 miles is now paved, 300 miles macadamized, and about 1000 miles are gravelled. Behind this road is the Lincoln Highway Association composed of our best business and professional men. A quotation from their last report is entitled to great consideration, and to be repeated here and as follows:

"From a study of highway costs and annual maintenance charges on all types of construction along the Lincoln Highway for the past nine years, the Lincoln Highway Association is more than ever convinced of the wisdom of its policy adopted in 1913, of advocating concrete construction where practical, on the Lincoln Highway as being the cheapest in the long run." Further along in the report, referring to the line, made of concrete, from Chicago to the Mississippi River the Association says, "The maintenance cost thus far has been negligible."

Experience with concrete roads is not sufficient to show how long the surfacing will last. We are using roads that are 20 years old, made of one course concrete where the wearing surface is in first class condition. Seemingly it will last indefinitely. In any event our most competent and experienced road engineers advocate alone this class of construction for permanence.

Character of Traffic

Again we must consider the character and the weight of the traffic. Some jurisdictions limit the vehicular load weight and yet we may be compelled to change because that may not be considered sound economics. It may be that we must increase the thickness of the surfacing so as to meet the contingencies involved in the increasing load which may be carried by the gasoline driven vehicle. For instance New Jersey is rebuilding the road between New York and Philadelphia with single course, concrete 10 in. thick to carry the rapidly increasing truck freighting.

The Kings highway is supposed to be for the free use of anyone who may choose to use. When this principle was adopted the "whiz" wagon was not dreamed of. But, in the last few years we see gasoline vehicle lines paralleling railroad lines, the one occupying a free track and right of way without upkeep charge or taxes which the other is compelled to help build and at the same time build and maintain its own road bed and way and in addition pay a tax annually thereon as well as upon its rolling stock, and be publicly regulated while the other goes practically free. These public conveyors on highways have robbed the railways of practically all their well paying short-haul freight out of the larger cities, particularly, and paralyzed the profitable suburban travel which was enjoyed by the railroads to a very large degree. This condition cannot be changed, but if one class of publicly controlled utilities shall be called upon to sacrifice its business, then those who took it should compensate the public by the lower rate or pay for a goodly portion of the cost and upkeep of the highway which is used. This conclusion is sound economically and the principle must prevail.

Licensing of Motor Vehicles

In part, this problem has been solved by the levy of an extra tax or a license fee, usually based upon horsepower, to be paid by the owner of the gasoline vehicle. It has not yet been sufficient to equal the reasonable value of the privilege conferred, and now that many people own these vehicles the tax is growing rather unpopular and possibly may not be raised much higher. However, bear in mind that the license rate usually is the same where the vehicle is employed in public conveyance as in individual use. Clearly a distinction should be made so that the public conveyor shall pay a much larger fee.

That which destroyes property or property value is a wrong to the whole people, because when property is lost or destroyed it is not alone a loss to the owner, but the value thereof must finally be absorbed by the whole body politic in the general distribution of loss charges for operation of business and affairs. Therefore, if the highway competition shall become so keen as to destroy railroad values, as it has in many instances, some creatively curative plan must be evolved or the country suffers.

The Remedy

In my judgment the remedy lies in the "back to the farm" movement. If we lose values some places, as I stated before, we must make it up somewhere else or the country ultimately would go to ruin. In your great wheat belt you have raised as much as 300,000,000 bushels of wheat per annum and yet your economists tell us that if you would intensify your culture, bring into crops the lands unused that are tillable and had the population to handle your fields you could increase that growth more than three times or make it a billion bushels. Contemplate what vast wealth this promises and the untold good it could bring to the Dominion. May this be realized, is the hope of your nearest neighbor.

Study the gradients of your roads and the conditions of the surfacing. If that amount of grain were raised, it is questionable whether it could be marketed, considering the character of highways over which it must be hauled to the railways. I am told that the average haul of grain from the farm to the market in your great wheat region is not much above 50 bushels. By experience in certain of the wheat districts of the United States we have found that 40 bushels was a good average load under the old conditions, but now with the cement roads of not exceeding 5 per cent. gradient, no farmer thinks of taking to market less than 110 bushels with the same team that would haul only 40 bushels before.

Getting Farm Products to Market

What is said about hauling of wheat applies to all farm products. The way to make farming profitable is to begin economy at the beginning and continue until the product is with the consumer. The beginning point is good roads. In order to fully work out the road problem, however, and reduce the original cost of the farm product we must go further and help the farmer in the sale of his produce. By experience, we find that cooperative selling and handling is the only true method. Liberal laws have been passed therefor, but, legislators have not gone far enough in giving the aid necessary, and largely so because the subtle and ever present influence about legislative halls, of the middlemen and the absence of the farmer, makes it difficult, to clearly understand the situation and solve the problem.

The result of the cooperative work among the milk producers of New York and adjoining states shows, that, by intelligent cooperative selling and handling, the producer receives a larger unit value at his farm, while the consumer pays less than he did under the old plan with its cumbersome machinery and innumerable middlemen who "Toil not, neither do they spin" yet no one drives more high-powered automobiles or wear more gaudy robes than these. This intervening class of trader will, of course, not be entirely eliminated, but by cutting out one-half this unearned increment, which can readily be done, here will be a tremendous advantage to the consumer and one hundred per cent. of any nation are the consumers.

I have spoken before of the railway situation. The trouble throughout your Dominion and the United States is that the rate is too high, having not yet been reduced from the rate induced by war conditions. The rates have fallen some, but in order to stimulate the business and run the railways to capacity the rate must be lower. It is capacity transportation that makes the profit, while with limited transportation ruin is sure.

The permanent highway will bring down this rate and force prosperity upon a sometimes unwilling railroad management and thus meet enonomic conditions as they exist. While it is admitted that good highways take away from the railroads some of its business, yet on the whole the railroad is in the end benefitted if husbandry is properly fostered.

Highways and the Future

Nothing in the world will dispel so much ignorance and promote so well, industry, advancement, better understanding, prosperity and the future well-being of a people, as the building of permanent highways.

In this we cannot go too far. The whole economic situation and future of our race and civilization rests, and is based upon the farm. If we make it impossible for the farm to succeed or the farmer to make money, the end will come. Rome fell because; first, all people, if possible, wanted to go to the cities for the misunderstood "white lights" making it impossible for the farmer, who was little better than a slave, to succeed; and, secondly, by the very force of circumstances and conditions existing the farmer finally was enslaved and then like all slaves he quit working unless goaded by the lash. This is looking at a dark picture. This may be considered placing a black cloud over us. It is not. However, sounding an alarm in time to avoid a possible condition that might exist, if we do not possess the courage, the integrity, and the spiritual conviction to avert what might be a catastrophy, is indeed violence. What is said here is for the purpose of inducing constructiveness before danger really comes. But the genius, the patriotism and the goodness of our great race, whose course has ever been upward and onward, will truly achieve a wonderful success and prevent a single backward step.

The State Highway Department of Pennsylvania is now marking the main highways of the state with color bands. In this route marking, three colors are being used: blue, red, and yellow. The blue routes will cross the state from north to south; the red routes from east to west; and the yellow routes diagonally.

The Federal Aid Act and Its Relation to State Highway Financing

By R. M. HUBBARD

Chairman, Texas State Highway Commission

The old idea of road building was that the people who lived along the road were the only ones benefited by the improvement and should therefore pay all the cost of securing same. This led to the construction of purely local roads, of a very temporary nature, and the natural results of such a policy was that we failed to get not only a correlated system of roads, but also in some instances, value received for the roads that were constructed.

The theory now generally accepted by those who have given the matter any study at all, recognizes the benefit of a substantially constructed, well located, and connected system of roads to the public in general, as well as to the local users; and the irresistible conclusion is that the national and state governments have adopted a wise policy in largely participating in the burden of securing the same.

Highway development is no longer a community undertaking, but is a most important and pressing subject of public interest, second, possibly, only to education; and both should progress hand in hand, and side by side. The importance of more durable types of road, the continuity of the system, and the absolute necessity of maintaining the roads after they are constructed, is now acknowledged by almost every one.

The action of Congress when it, in 1916, passed the first Federal Aid Act, was the real and impelling cause of the great wave of road building enthusiasm we have witnessed in the past few years. The main purpose of that act was to stimulate interest and promote state legislative action in financing a state system of roads, in turn to connect up with the systems of the adjoining states and thus form a national system.

The Purpose of Federal Aid

We have lately come to realize that the federal government made a very modest beginning at the time of the passage of the original Federal Aid Act. That measure appropriated 75 million dollars for the purpose of aiding the states in the construction of state highways. It covered a five-year building program, commencing with the year 1917; and was to be expended as follows: One-fifteenth the first year, two-fifteenths the second year, and so on until the entire amount was exhausted. The roads on which this money could be expended were to be located by the various State Highway Commissions, and the amount to be expended allotted by them, but limited to not exceed fifty per cent. of their cost. Congress, early in 1919, assuming that it was necessary to provide employment for returning soldiers, appropriated 200 million dollars more for road construction. This appropriation covered a three-year period—1919, 1920 and 1921 By a bill passed in the fall of 1921, 75 million dollars more were added to the Federal Aid Act, to be expended during the year 1922. Hardly anyone familiar with the situation now doubts but that the Federal government has just really started in its road building program.

The method used in distributing the federal appropriation is divided into three parts. The first part is then apportioned to the states according to the ratio that the population of each state bears to the entire population of all the states. The second part according to the ratio of each state, to the area of all the states, and the third part according to post mileage.

How Federal Aid Is Applied

In endeavoring to comply with the requirements of the act in this respect, the amount of state funds provided in many cases has proven so pitifully meager in comparison with the huge amounts of money voted by the counties, the commissions have found it impossible to meet the public expectations in the development and construction of a serviceable, connected system of roads. Instead, therefore, of using state and county funds to match federal funds, they have been compelled to use it in augmenting the federal funds in matching the county money as far as possible. Furthermore, inasmuch as both federal and state funds have not been sufficient to match even on a 50-50 basis the funds voted and furnished by the counties, the commissions have had to rely on the counties to furnish the greater portion of the money used in the construction of state highways —a plan not at all satisfactory in its results. Under our present road building system the counties have to bear the burden of not only building their own local systems, but also the major portion of the state system. Also, under our present system, caused by constitutional and legislative limitations, the initiative is left with the counties, and the types of roads through each county is necessarily limited by the amount of funds provided by each county, and in addition subjects the entire road, program to local, personal and political influences, a very grave objection.

The Need of a State Road Fund

It can readily be seen that under such a system of road building there can be no uniformity in type of construction, and on account of lack of funds in some counties, in a great many instances, it is absolutely impossible for a county, even with state and federal aid to connect up with the roads of the adjoining counties, leaving a gap, too often in an important highway, that cannot be financed at all.

(*Concluded on Page* 82)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
Editor

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

Volume LXIII August 30, 1922 Number 9

SIX MONTHS' PROGRESS

Nearly 600 miles nearer the goal of a completed system of highways for the United States is the report of the U. S. Bureau of Public Roads for the month of July. The final goal, the construction of a system of approximately 180,000 miles of Federal-aid highway consisting of a network of trunk line and secondary roads reaching into practically every county is still a long way off, but we are 5392 miles nearer than at the beginning of the year.

Completed Federal-aid roads now total 18299 miles with 14912 miles under construction and approximately 60 per cent. complete. Including projects not yet under construction Federal-aid roads in all stages now total 40338 miles.

There is no indication of any slackening of the greatly increased rate of progress which began with the season of 1921 as the states continue to pour in plans for new projects and place them under construction as rapidly as possible. Nearly twelve and one-half million dollars was obligated to new projects in June and July, and in the week ending August 5 reports were received of the letting of 68 new projects and of 57 to be let.

PAVING MATERIAL NOT TAXABLE

A district court of Nebraska has ruled that building materials piled along the street, awaiting use in a paving job, is not taxable property and has directed that there be stricken from the tax books of this county the assessment of a tax on 1,500,000 brick, two cars of cement, two cars of asphalt and ten cars of sand, all valued at $52,260.

The materials were the property of the Chapin-Colglazier Construction Company, and were assessed a year ago as personal property. The county assessor claimed that the materials was taxable property because it had not been turned over to the city. The contractor protested to the commissioners but they decided against him and he appealed to the district court.

This case has attracted considerable attention among contractors not only in Nebraska, but in other states. The *Republic*, of Aurora, quotes J. J. Rienhardt, county attorney, as saying that the county plans to appeal the case to the supreme court and that a similar case has arisen in Kearney County, Neb. In the latter instance the case involves the assessment of sewer pipe in the street.

MINNESOTA MAKES FAVORABLE SHOWING IN GOVERNFENT FIGURES ON FEDERAL AID

Minnesota under the so-called Babcock good roads plan is carrying on federal aid highway improvements more than double in number and covering nearly five times the mileage of the average for the United States, according to a recent bulletin from the government Bureau of Public Roads. The figures supplement the report giving Minnesota first place among the states for the longest mileage of completed federal aid highways and indicated that this state is putting funds on the road as fast as they come in. Minnesota is credited by the Bureau of Public Roads with 110 jobs on which federal aid is being used, compared with 50 projects in the average state. Minnesota improvements under way cover 1145 mi. against the 280-mi. average for all the states. Projects average 10.4 mi. in this state and 5.5 mi. in others.

Cash outlay comparisons disclose that Minnesota is not extravagant in building roads. Its average federal aid project now totals $95,289 of which 39 per cent or $36,925 is government money, while the average state job total is $100,326 including 42½ per cent or $42,615 of federal aid. Again, Minnesota is using $9,150 a mile against $18,050 or nearly twice as much for the general average among the states.

I. C. C. ALLOWS LOWER RATE ON ROAD-BUILDING MATERIAL

In the shipment of surplus war materials transferred to them by the U. S. Bureau of Public Roads, state highway departments will be saved a great deal of expense as a result of a ruling of the Interstate Commerce Commission permitting the shipment of this material as "contractor's equipment," thereby giving it the advantage of a low rate.

The railroads previously required the States to pay less-than-carload rates on the various items included in such shipments, even when together they made up a carload. The contention of the bureau is that since the bulk of this material has been used and none of it is new, and since it is all intended for use in road construction, it should be given the advantage of the low rate allowed to contractor's equipment. This contention, which was opposed by the railroads, was upheld by the Interstate Commerce Commission.

The rate is now applicable to some 1,200 carloads to be shipped from Camp Grant, Ill., and large quantities from other points. On a carload shipment from Schenectady, N. Y., to Boise, Idaho, $720 recently was saved, and $500 on another from San Antonio, Tex., to Salem, Oreg.

MASSACHUSETTS GATHER FIGURES ON MOTOR VEHICLE LOADS

During the past two years, and particularly in 1921, the Department of Public Works of Massachusetts has employed an investigator to ascertain what loads were being carried over the highways and to prosecute the law-breakers as he found them. The extent to which the state law limiting gross weights to 14 tons and weights per inch width of tire to 800 lb. has been ignored is remarkable, according to Arthur W. Dean, chief engineer, division of highways, in a recent address before the Boston Society of Civil Engineers.

Trucks having a rated capacity of 5 tons and weighing approximately 5 tons were carrying loads weighing from 10 to 15 tons, so that the total load of truck and vehicle was approximately from 15 to 20 tons. With the worn-out tires on many of the trucks the load per inch width of tire was approximately from 1,000 to 1,500 lb. Statistics under preparation by the department show that this overloading is not confined to isolated cases, but is very frequent, and must be considered not only in connection with road surfaces and foundations but in connection with the designing of bridges.

EXCURSION TO SOUTH AMERICA

A winter excursion to Panama, Argentine and Brazil to study opportunities for construction work is proposed by *The Earth Mover*, of Aurora, Ill. It is planned to start early in December and remain two or three months visiting the principal cities and such construction operations as are accessible along the main routes of travel.

It is believed that a visit by a representative body of American contractors would result in some contracts, as well as establishing acquaintance and confidence leading to future business relations of mutual benefit and profit. Contractors interested in the trip may secure further information by addressing the editor of *The Earth Mover*, Aurora, Ill.

A recent opinion by Attorney-General U. S. Lesh, of Indiana, given to the State Highway Commission of that state holds that the commission is not required by law to repair and maintain streets in incorporated towns where the streets connect state highways. The commission has discretionary powers in regard to making these improvements, the opinion holds.

MINNESOTA TO SPEND $300,000,000 ON ROADS DURING 1922

Minnesota will spend more than $30,000,000 for good roads again this year, according to official figures just compiled. About one-third of the available total will be used on the 7,000 miles state system of trunk highways under the Babcock plan and the remainder will be expended by county and township authorities on local roads or the secondary system.

Among the items on the trunk highway budget are 684 miles of extensions of Minnesota's system of gravel-surfaced roads and 386 miles of grading.

Trunk highway funds in Minnesota for 1922 include $5,650,000 of motor vehicle tax revenue, $2,563,000 of federal highway aid and $2,400,000 net of county reimbursement bond funds, all to be used on the trunk system.

State highway aid aggregating $2,200,000 was apportioned to counties and with nearly $18,000,000 of a local tax revenues will be used on the secondary highways.

ROAD BUILDING IN INDIANA

Plans are being perfected by the Indiana State Highway Commission to close the gap and extend State Road No. 40, between Madison and Scottsburg, John D. Williams, Director of the State Road Bureau, announces. When this single gap system becomes a part of State Road No. 40, this highway will connect Lawrenceburg and Scottsburg, and make possible a continuous highway between the county seats of Dearborn, Ohio, Switzerland, Jefferson and Scott counties.

"The linking up of this highway with State Road No. 1 at Scottsburg means much for the convenience of traffic from the counties of southeastern Indiana which, when it is completed, will have a direct route westward and avoid traveling further south and in close proximity to the Ohio River to get across that section of the commonwealth. Connection of State Road No. 40 with State Road No. 1 at Scottsburg also gives traffic from the east a direct route south out of Scottsburg to Jeffersonville for a state road connection to French Lick and the famous watering resorts of Orange County. North out of Scottsburg, traffic coming west over State Road No. 40 will have a direct route almost due north across the state over State Road No. 1 through Seymour, Columbus, Indianapolis, Kokomo, Rochester, Plymouth and South Bend to the Michigan-Indiana state line where connection is made with a hard surface road into Michigan.

"Recently the Indiana State Highway Commission announced a part of its 1923 hard surface building program showing that State Road No. 1, the Range Line route, is to obtain over 60 miles of rigid type pavement next year. A large portion of this is on the southern end in the vicinity of Seymour. The program also calls for paving the road between Indianapolis and Kokomo."

MOVING PICTURES TO SHOW VARIOUS TYPES OF HIGHWAYS

A series of one-reel motion-picture films illustrating modern practice in the construction of the various types of highways has been prepared under the direction of the U. S. Bureau of Public Roads and are now available for free distribution.

The films, consisting of one-reel each, are as follows: "Modern Concrete Road Construction"; "Building Bituminous Roads"; "Mixed Asphalt Pavements"; "Brick from Clay to Pavement"; "Granite Block Paving"; "High Roads and Sky Roads."

In addition there will be completed in a short time "Building Forest Roads" and "Around the West by Forest Roads." A film on gravel-road construction is in course of preparation.

These films are intended for use in engineering colleges, road meetings, and other public gatherings. They may be obtained upon application to the department for use on specific dates without cost other than that of paying for transportation both ways.

MISSOURI TO SPEND TEN MILLION ON ROADS

Several million dollars' worth of highway contracts, it is expected, will be let in Missouri before the first of the year as the result of the designation of a 1,500-mile system of primary state roads in a report just submitted to the state highway commission. Missouri has already voted $60,000,000 of bonds to be used in the construction of 76,000 mi. of state roads. The law provides for the selection by the commission of 1,500 mi. of this system to be classified as primary or trunk-line routes. The commission has planned to hold a public hearing this week to consider the recommendations of its engineers and will then reach a final decision regarding the issuance of $10,000,000 at once to enable work to be started.

EMERGENCY MET BY FEDERAL-AID ROAD

A federal-aid road has just been completed in Arkansas, which, according to the U. S. Bureau of Public Roads, has already saved millions of dollars to the community in which it is built. Recently during high water in the Mississippi woord came to Helena, Ark., that the levee at Old Town, 17 miles away, was about to break. The situation was critical. A few hours' delay and thousands of acres of rich farming land would be flooded and possibly many lives lost. Helena was the only source of aid and many men with tools and material were needed. Every available motor vehicle was pressed into service and over 600 men, properly equipped for the work, were in a short time speeding over the new road to save the levee. They arrived in the nick of time and by almost superhuman effort dammed the rising waters.

By the close of 1922, 2009 miles of permanent state and federal aid highway will have been constructed in Nebraska, according to the records of the State Department of Public Works.

WAR MATERIAL DISTRIBUTED

The U. S. Bureau of Public Roads has reported that on July 1 there had been delivered to various states for use in road construction surplus war material valued at $139,773,986. In value of material delivered, Texas and New York lead with nearly $8,000,000 worth; and all but five of the smallest states have received material valued at more than $1,000,000. The material includes 24,752 trucks and 4,573 automobiles.

In the first quarter of the present year plans and specifications were prepared by the Wisconsin state highway department for 150 bridges at an estimated cost of $527,900. In the same period last year plans were drawn for 137 bridges at an estimated cost of $553,300.

MEETINGS

Calendar of Coming Meetings

Sept. 5-7—Engineering Institute of Canada; Professional Meeting, Winnipeg, Man.

Oct. 2-6—Ameircan Society for Municipal Improvements; Annual Convention, Cleveland, Ohio.

Oct. 4-9—American Society of Civil Engineers; Fall Meeting, San Francisco, Cal.

HIGHWAY TRANSPORTATION ENGINEERS TO MEET IN OCTOBER

Engineers and leaders in highway transport are evincing interest in the forthcoming second national conference for the study of highway engineering and highway transport, which will be held at Washington, October 26 to 28 inclusive.

According to a statement of the program committee the object of the conference is to "review the field of highway engineering and highway transport education in the light of the expanding state and highway program, and the rapidly increasing social and commercial use of the highways; to discuss general and special courses in undergraduate and graduate curricula, and to exchange views on educational trends arising from these developments in the national transportation system."

On the program committee are Professor T. R. Agg, professor of highway engineering, Iowa State college, Ames Iowa; Professor Arthur H. Blanchard, professor of civil engineering, University of Michigan, Ann Arbor, Michigan; Professor C. J. Tilden, professor of engineering mechanics, Yale university, New Haven, Conn.; Professor Lewis W. McIntyre, professor of civil engineering, U. of P., Pittsburgh, Pa.; H. G. Shirley, chairman Virginia State Highway commission, Richmond, Va., and Dr. Walton C. John, United States Bureau of Education, Washington, D. C., chairman.

FEDERAL AID ACT AND STATE FINANCING

(*Continued from Page* 78)

The fact that the Federal government has adopted a policy of aiding the states in the construction of state highways on the theory that it is a public benefit, is the more reason why the states in turn should provide from a state fund the money necessary to match the Federal funds in the construction of a state system. From general appropriations, the state provides funds for the construction of a state system of roads. If necessary, change the constitution. If unnecessary, enact the legislative measures required to attain the greatly to be desired result.

Another strong reason why the state should provide an adequate road fund lies in the fact that an essential factor in successfully carrying out a road building program is that of forming a definite one, to be extended over a period of years. This cannot be done unless we have a certain fixed state fund. The counties cannot be expected to furnish more funds after they have once voted large bond issues. With very few exceptions, they have shot their last arrow. The outstanding fact in any road building program is that it takes money to construct roads, and if the people of any state ever expect to see a "Sure-enough" state system, then it behooves them to see that the necessary funds are provided.

There is another very forceful and cogent reason why the state should provide a road fund. As explained under our present system, we have had to rely on the counties to vote the bonds and furnish the money to match the Federal funds. The Federal Aid Act passed by Congress in the fall of 1921, contained several provisions altogether new and very far reaching in their character and effect. It limited the system of each state on which Federal aid could be expended to 7 per cent. of the total mileage of public roads in each state. It provided that the Federal aid had to be matched with state, not county funds, and these funds must be placed under the direct control of the State Highway Department, and the authority to expend same be placed in the department. Probably the most striking and salient provision of the new act, in addition to the above, is that if the state fails to maintain a state highway partially con-its maintenance, and shall charge the cost of same to the funds allotted to that state and *shall not approve* any more projects until the federal government has been reimbursed by the state for such expenditure.

It is now a vital and all important question as to whether the states will take up the good work begun by the counties and carry the same to a successful completion. Experience has clearly demonstrated the fact that the only satisfactory method of securing a state highway system is for the state to provide the funds and take direct charge of the work. It will relieve the counties of the expense of constructing and maintaining the state system and leave their available funds to be used strictly on their local roads.

MAINTENANCE OF MACADAM ROADS

(*Continued from Page* 74)

against shortage of labor upon those sections of the road that are removed from the thickly populated districts. The matter of control of a force of this kind can be taken care of by a full report of the operations and the expenses of the work. This method was used by us to a great extent in the past few years on account of the labor shortage during and directly subsequent to the war.

Average costs covering 11,017 mi. of federal aid highways were recently stated by Thomas H. MacDonald in an address before the Chamber of Commerce of the United States to be as follows:

Class 1, including the graded and drained, the sand-clay and gravel types— $11,320 per mile.

Class 2, covering macadam, waterbound and bituminous types—$20,540 per mile.

Class 3, covering the bituminous concrete, portland cement concrete, and brick types—$36,100 per mile.

PERSONAL MENTION

Frank B. Newton, for several years county engineer of Jasper County, Missouri, has resigned to accept a position in the construction division of the Missouri State Highway Department.

Squire E. Fitch, Westfield, N. J., has been appointed county engineer of Chatauqua County, N. Y.

M. A. Gould, assistant engineer with the Illinois Division of Highways for the past few years, has been appointed instructor in the civil engineering department of the University of Idaho.

M. B. Greenough, who has been secretary of the National Paving Brick Manufacturers' Association for the past several years, will sever his connection with that organization January 1, 1923, after which date he will be associated with W. M. Lasley, of the Southern Clay Manufacturing Co., Chattanooga.

Ray Z. Myers has been made an assistant division engineer of the Ohio State Highway Department. He was formerly assistant engineer of Licking County, Ohio.

W. A. Stacey has been appointed county engineer of Reno County, Kansas, by the State Highway Commission.

J. Thompson Brown has been appointed general manager of the explosives department of the E. I. du Pont de Nemours & Co., to succeed the late Charles A. Patterson. Mr. Brown was first employed by the du Pont Company in 1903 and has been engaged in plant engineering and special and general operating work at the high explosive plants. He has held the positions of secretary to assistant director, manager of dynamite works, general superintendent of the high explosives division, and finally assistant general manager of the department.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor

E. W. TREE, Managing Editor

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TABLE OF CONTENTS

The Construction of Concrete Roads 83
By James Allen

The Elk District Highway 85
By Samuel H. Lea

Light Weight Concrete 86

EDITORIALS AND NEWS

Safety First at the Road Crossing 87
National Highways 87
Automobile Courtesy 87
The Federal Highway Act 87
North Carolina Receives Bids for $4,600,000 on Road Construction 88
I. C. C. Permits Use of Open Top Cars for Movement of Road Material 88
California to Spend $65,000,000 on Roads in Five Years 88
Colorado Highway Department Reports on Unit Prices in 1921-22 88
Montana Leads Mountain States in Road Building 88
Miniature Bridge to Aid Engineers Solve Problems 89
Chicago Forest Preserve to Spend $2,000,000 . 89
Indiana to Test Emulsified Asphalt Pavement . 90
Michigan Roads Total 71,500 Miles 90

EQUIPMENT-TRADE-MATERIALS

Reo Speed Wagon for Road Maintenance . . . 89
New Equipment Lease Issued 89
Austin Issues Valuable Folder 89

PERSONAL MENTION 90

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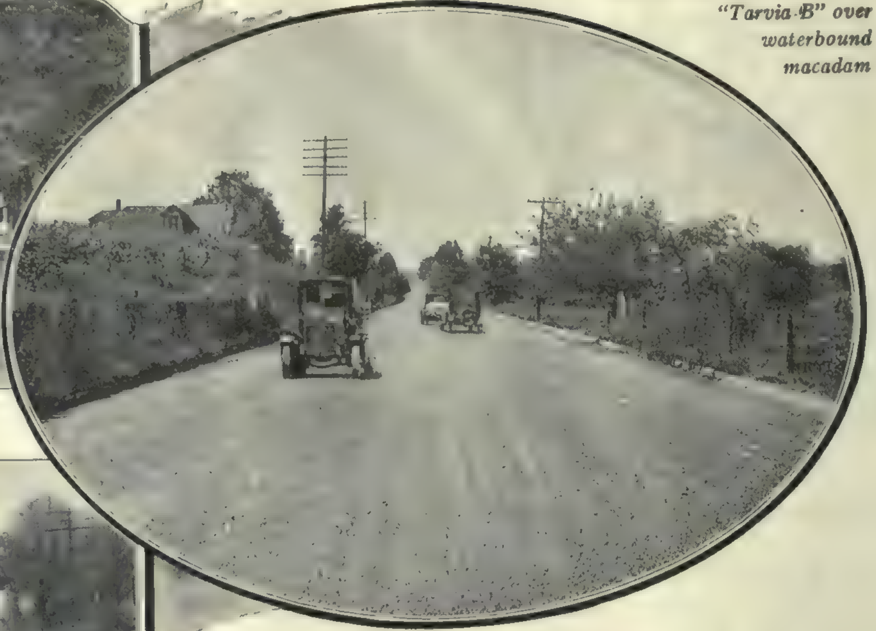
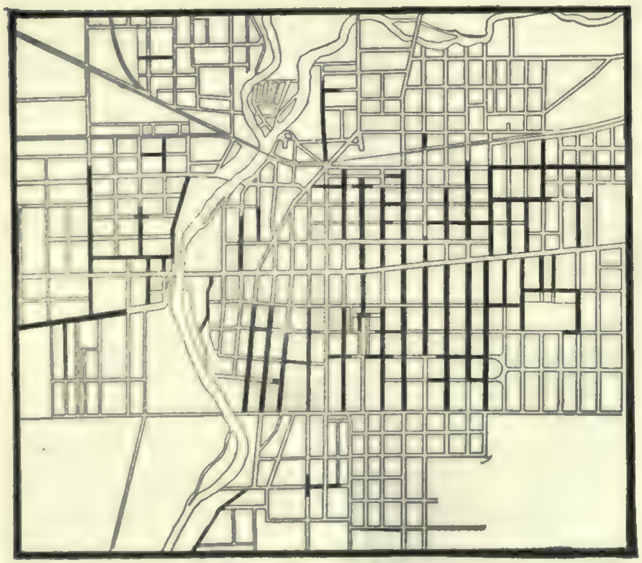
North 15th Street, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Liberty Pike, Richmond, Ind. "Tarvia-B" over waterbound macadam

Chester Pike, Richmond, Ind.—Macadam maintained with "Tarvia-B"



Heavy black lines indicate Tarviated Streets in Richmond, Ind.

Here's what Richmond, Ind. thinks of Tarvia—

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GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE
WITH WHICH IS INCORPORATED
THE HIGHWAY CONTRACTOR AND ROAD BUILDER
Vol. LXIII SEPTEMBER 6, 1922 No. 10

The Construction of Concrete Roads

A Discussion of the Subgrade and Drainage Problems; Stresses in Pavement Slabs; and the Elimination of Cracks

By JAMES ALLEN
Supervisor of Highways, Washington.

SELECTION of types of pavement for our rural highways is a comparatively modern problem. Prior to 1905 there were but few rapid moving vehicles and these were confined largely to our city streets. The highways with gravel or macadam surfaces in those days were entirely adequate for the horse-drawn traffic and easily and cheaply maintained, and the paved streets of the cities cared for both classes of traffic in a satisfactory manner.

As the automobiles became more numerous and traveled farther afield, their usefulness increased and they changed from an experiment to an essential part of the world's transportation system. A new problem confronted the engineers, not many of whom realized that the conditions were much different than those surrounding the paving of a city street. It is well recognized now, however, that the character of traffic changes from comparatively slow moving vehicles evenly distributed over the width of a city street, to rapidly moving vehicles concentrated into two lines of traffic on the highway. The destructive forces set up by this high speed traffic have been studied and we are now measuring the forces that destroyed many of the earlier highway pavements; forces that all practical engineers recognize and prepare for in their designs.

Selection of Routes

In order that a paving program may be a success, a definite highway system, designed to serve the majority of the people, must be selected, adhered to and built up by a continuing program covering a period of years. If the routes are not well selected, they must later be changed and the money spent on abandoned sections will serve for local purposes only. The people will get along with the poorly selected highways for a few years, but it is only a matter of time before a demand will deelop for the most direct and practical route from the point of view of the motor vehicle operator. A highway must be safe, and it must serve the majority of the people. The location of a highway to secure the best route that the terrain affords, the most economical route, cost of operation and maintenance considered, is just as important as is the selection of a route for a railway, and it deserves the same thorough study.

Importance of Subgrades

A pavement is a slab supported by the earth subgrade and in a broad way the four things to be considered in the structural design of the subgrade. (1) The supporting power of the subgrade. (2) The climatic conditions. (3) The traffic that the pavement also must carry, and (4) the serength of the pavement slab.

A good subgrade must be constant in volume, homogenerous in character and have a supporting power on which the design can be based. Many soils undergo a change in volume with the addition or subtraction of water, thereby changing the points of support of the pavement. If the soil increases in volume near the edge of the pavement only, the upward thrust will introduce unusual stresses in the pavement. Or if the soil, by reason of the loss of moisture, shrinks near the edge of the pavement, leaving the pavement unsupported, the wheels of traffic will break down this edge until it is supported by the soil. If a subgrade is not constant in volume, the design must provide for the change in the position of the support afforded the pavement. The pavement must be uniformly supported in order that the stresses may be equalified and distributed in all directions in the slab. If they are concentrated by hard or soft spots in the subgrade, the pavement must fail first at these points. A subgrade constant in volume and homogeneous in character must also have definite supporting power on which the design of the slab may be used.

There is, perhaps, no subject that has been written of and spoken of so often and neglected so much as the subject of drainage. The surface and ground waters must be remoed away from a pavement if the pavement is to last. This is particularly true if the frost penetrates

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Abstract of a paper presented at the Ninth Annual Convention of the Canadian Good Roads Association, June, 1922.

the ground more than 6 or 8 in. The upheaval of pavements due to frost action is a very common occurrence and one of the seriously harmful agencies to be understood and cared for. Good drainage and a thorough understanding of climatic conditions are necessarily a part of the success or failure of a pavement. Changes in the temperature of the concrete slab and changes in the moisture in the concrete develop forces that are to be provided for and worked with, rather than resisted. The natural forces as well as the forces of traffic must be studied and met in pavement design.

Character of Traffic Changes

It was little thought fifteen or twenty years ago that the volume and character of traffic on our modern highways would change so tremendously. The number and size of vehicles grew by leaps and bounds, as also did the loads that they carry. The five or seven passenger car grew to a twenty or twenty-five passenger bus; the one-ton truck to the huge freight and logging truck of today. It seems, however, that this growth must be, and in fact it is, being controlled by legislation in the interest of the limit of our financial ability to construct pavements to withstand the loads. Without legislation to control the maximum sized truck and the distribution of its weight upon the pavement, it would be impossible to maintain our highways and reap the benefits to which we are entitled by reason of the public funds invested in the highways. Pavements, of course, can be built to withstand any given load, but the funds needed to pay for them, would bankrupt our people. I suggest that the load be limited to 18,000 lb. to any one axle and that the vehicle having four wheels be limited to 12 tons. In studying this subject, the causes of and the amount of impact must be known. Tests have been made along this line that have demonstrated the value of pneumatic and solid rubber tires and the much greater impact with solid rubber tires as compared with pneumatic tires. While the volume of traffic is important, its character is vital, and the loads must be thoroughly studied.

In the early days the stresses in the pavement slab were not calculated. The problem, being one of mechanics, involving a multitude of stresses acting from below as well as from above, justifies a vast amount of research work that is now being attacked in a scientific manner. The technical data developed regarding the character and impact of traffic and its effects on the pavement, the supporting power and reactions of the subgrade, the distribution and ariations of the subgrade reactions and the stresses in the various parts of the pavement slab are technical and too involved to be discussed at this time. Progress in research is very rapid and, while it is improbable that we shall ever develop short formulae that will be adequate, it nevertheless will be possible to design an adequate and economical pavement after a thorough study of the subgrade, the traffic and the materials of which the pavement will be made.

The ordinary defects found in concrete pavements are broken corners and cracks, both longitudinal and transverse. Pavements inadequate because of design, faulty materials or faulty construction as to gravel and break down completely, are not considered here for the reason that this condition can be avoided without any great difficulty. Broken courses, having a length along either leg of 2 or 3 ft. are serious and should be avoided by a proper thickness of slab. The corner of a slab or section of pavement has been demonstrated to act as a cantilever beam and can be designed as such, considering the maximum wheel load, impact, and the strength of the concrete. This calls to mind again the necessity of limiting the wheel load to a given maximum as a basis for design. A pavement designed to have sufficient corner strength to carry a certain traffic will be adequate as far as shearing or punching strength at other points is concerned. Transvers and longitudinal cracking cannot be so easily eliminated. These cracks are caused by stresses due to beam action in the slab, unequal expansion and contraction, due to moisture and temperature changes, frost action and unequal support afforded by the subgrade. The subject is being studied and the question arises as to how far we shall go in expense to avoid cracks altogether. At first a crack was thought to be a sign of incipient failure. Experience has shown, however, that from a maintenance and operating point of view, they are not fatal; it is still a matter of opinion as to how serious they are. There are many pavements eight to ten years old that are badly cracked and they continue to give good service, at a comparatively low cost for maintenance.

Importance of Testing Material

Sand is "just sand," and gravel "just gravel" to the average man. To the engineer, however, they are an important part of his work and must be thoroughly tested to determine their fitness for concrete construction. It is also necessary to test the cement and the water proposed for use in concrete construction. The possible sources of sand and gravel should be thoroughly examined before the contract for a pavement is awarded. The examination should include test holes to determine the quantity of materials available, and the sand and gravel should be thoroughly tested to determine their suitability or the possibility of washing and regrading to make them satisfactory. This information, if available to contractors, will eliminate the most extreme and risky gamble connected with pavement construction. It is also advisable to acquire the property for the development of side of the road pits, as the municipality is in a better position to purchase the land from which the sand and gravel are to be taken than is the contractor. If the property is made available to the bidders by the organization awarding the contract, all bidders are on the same competitive basis; if, on the other hand, one contractor should acquire the property to the exclusion

(*Concluded on Page* 90)

The Elk District Highway

A New Road in the West Virginia Mountains

By SAMUEL H. LEA

Highway Engineer, Mineral County, West Virginia.

THE Elk District Highway in West Virginia which connects the Maryland road system with the Northwestern Turnpike in West Virginia, extends from Blaine on the Potomac River to the summit of the Alleghenies, a distance of 7.67 miles, and it ascends in that distance 1120 ft. The design and construction of the highway meets with all state standards. The roadway itself is 24 ft. wide; its maximum gradient is 9 per cent; the sharpest curve is 40 deg. and much of the road required in its construction was side hill cutting which varied in depth from 10 to 30 ft. on upper side.

Views Along the New Elk District Highway

The funds for construction of the Elk District Highway were provided by a district bond issue of $137,000. This amount was augmented by Federal Aid to the extent of $27,920, the entire amount being available for the work thus totalling $164,920. The total expenditure for construction, however, was but $157,925, thus leaving an unexpended balance of nearly $7,000 which will be used for retiring the bonds.

In building the Elk District Highway the old county road was followed as closely as practicable and changes were made in only a few places where decided improvement was effected both in grades and alignment. At one place, Kensal Hill, the old road climbed squarely over the top of a ridge. The new road, however, flanks the ridge through a gap thus eliminating 40 ft. of unnecessary elevation with no loss of distance.

Throughout the course of construction excavation was chiefly carried on with the steam shovel, the material being hauled by teams in dump wagons and used for making fills. On the 9 per cent. grade up the Blaine hill the industrial railway was used; the cars were hauled up grade by a hoisting engine. On exposed rock ledges and large boulders the compressed air drills were used, the deeper cuts being drilled with the well drill.

The work of building the Elk District Highway was done under contract by H. W. Kaylor, of Hagerstown, Md., at the following unit prices: unclassified excavation, with free haul of 1500 ft., $1.10 per cu. yd. Vitrified pipe culverts furnished and installed: 12 in. diam. $1.80; 18 in. diam, $2.40; 24 in. diam., $4.50 per lin. ft. respectively. Class B concrete, $18.00 per cu. yd.

Based upon these unit prices the entire cost of construction was as follows:

Unclassified excavation	$120,105.21
Vitrified pipe culverts	7,575.64
Class B concrete	2,795.94
Borrow	4,812.50
Overhaul	1,217.66
Shale surfacing	7,374.38
Removal of slips	4,902.07
Right of way and fences	4,200.00
Engineering supervision (2.86 per cent)	4,505.20
Monument and water trough	435.60
Total cost	$157,925.20

Since its completion the Elk District Highway has been designated as a state road and will be maintained and surfaced by the West Virginia State Road Commission.

Landslides were common during the progress of the work and were chiefly of two general kinds: (1) where the material slid down from above the road into the excavation; (2) where the ground broke away on the lower side of the excavation, in some cases taking part of the road. On the steep hillsides the natural slope is 1½ to 1; the material is clay and loose rock, overlying shale and extending upward to solid rock. After excavating for the roadway in these sections, the clay and loose rock slid down over the shale into the cut, in some cases breaking back to the natural rock ledge 100 ft. away. The sliding on the lower side of the road was probably due to disturbance of equilibrium by sidecasting extra material from the cut. In some cases the hillside was saturated with water from coal mine workings and this material in the form of mud sloughs down into the cut, filling ditches and covering the roadway.

The steam shovel was used effectively in cleaning up these slides. The material was either sidecast or hauled away in dump wagons, loose material above the cut, stones and overhanging trees were removed by hand, and where the road was narrowed by a slip on the lower side, the cut was widened into the hill with the steam shovel. Everywhere the road is on solid ground, no attempt being made to preserve original alignment by retaining wall or rip rap.

Temporary Surfacing

After the work of grading was done it was decided to cover the roadway with shale at places where the formation is of clay. A length of about two miles was thus treated; the shale cover being placed to a depth of about 10 in. between side ditches. The shale was obtained from a borrow pit at Elk Garden where the steam shovel was placed and hauled in motor trucks to a distance of about 1½ miles. The unit cost for this work was but $1.25 per cu. yd., or 28 cents per square yard of roadway. This surfacing, will last for over a year; it makes a good roadway, free from dust and mud.

No streams of consequence are crossed by the road and on account of mine water, vitrified pipe culverts are used; these ranging in size from 12 to 24 in. in diameter. On the heavy grades culverts are placed at intervals of 300 ft., but on the lighter grades the spacing is from 600 to 900 ft. Concrete end walls are generally used; angle headwalls being built, however, on the steep grades.

Where slips were caused by seepage and surface water, drainage was provided by ditches and pipes. In one instance surface water on hillside above road was collected in a ditch and piped to the nearest culvert. At another place where water seeps through upper side slopes culverts are placed at close intervals; four culverts being installed in a length of 250 ft. of road.

Road builders throughout the country who followed with great interest the progress of the experiments on the test highway at Pittsburg, Cal., last winter, will be glad to know that the tests have been resumed. The experiments were discontinued on January 28 and since that time repairs have been made to the shattered sections to permit uninterrupted traffic.

LIGHT-WEIGHT CONCRETE

COLONEL Rabut, in a memoir to the Academie des Sciences, refers to the experimental researches in which he has engaged since 1909 on concrete made with slag of considerably lower specific gravity than that of the gravel and broken stone customarily employed. He has established the facts that, other things being equal, slag concrete is generally stronger, though sometimes a little weaker, than gravel conrete; that its weight is from 30 to 40 per cent. less than that of gravel concrete; and that the ratio of strength to weight attains maximum value when the proportion of sand is from one-fourth to one-fifth that of the slag used as aggregate. Proceeding to make pracical applications of his experimental results, Colonel Rabut has constructed in slag concrete the principal parts of two important works—the bridge carrying the station of Asnieres, on the outskirts of Paris, and the Lestonnat Jetty in the port of Bordeaux. He has recently completed in the Arsenal of Lorient, a large jetty entirely in slag concrete, including piles 65 ft. 6 in. long by 15¾ in. sq., and has constructed tank wagons and barges in the same material.

Experience in the United States has demonstrated the possibility of producing concrete of about half the weight of, and equal in strength to, concrete made with ordinary aggregates. While the reduction of useless deadweight is obiously economical in every class of construction, Colonel Rabut shows that it is specially advantageous in certain types of structures. For instance, in suspension bridges the employment of light concrete in the towers and platform is attended by great economy, particularly if the latter embodies stiffening girders, but the permissible length of span cannot be materially increased. In the case of arch bridges, however, a further advantage is obtainable. If the super-imposed load is small relatively to the dead load, the length of span, or alternately, the boldness of the arch, may be double that permissible for ordinary concrete; and even if the arch is to carry heavy railway traffic the advantages secured is fully 30 per cent. Similar advantages are attainable in the construction of reservoir walls and high chimneys, and still greater advantage in the case of piles, which are subject to maximum stresses while being handled before driving operations are commenced. Owing to the use of light concrete, Colonel Rabut estimates that for a given sectional area the length of a pile can be increased by 2.6 times that of a similar pile made of ordinary concrete. The possibility of light-weight concrete construction, undoubtedly merit consideration.—*The Times Engineering Supplement.*

Good roads will cut the expense to the farmer at least 50 per cent in the cost of marketing his crops. Also the thousands of men building roads must be fed, which makes a closer market for farm products. The money paid for making good roads does not get out of the country, but rotates among all the people.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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"SAFETY FIRST" AT THE ROAD CROSSINGS

All over the United States posters are now being displayed pleading for carefulness on the roads with reference to the crossing of railroad tracks. A campaign is on in an effort to make the crossings less deadly, although it would seem from the wide spread of such appeals that everybody in this counry by now has had the danger of grade crossings brought directly home and the need of care emphasized to him. Yet the death toll continues.

It is necessary, therefore, to make the crossings foolproof. The only way to do that is to make is impossible to cross them, and the only way, in turn to do that is to carry the roads over or under the tracks. It will, of course, take a long time to make these changes throughout the crowded part of the country, but meanwhile every grade crossing in the United States, especially in the neighborhood of cities, should be "protected," and the heedless, forgetful and reckless drivers reminded that death lies ahead.

NATIONAL HIGHWAYS

It is highly appropriate that the names of statesmen, who have been beacon-lights in our history, guiding their countrymen in the difficult ways of politics and government, should now be given to the improved highways traversing the States.

The North and West have the beautiful Lincoln Highway, and the Jefferson Davis Highway is now an assured fact. The Lee Highway, in all probability the route of greatest historical interest in the eastern part of the United States, will thrill the traveler throughout the entire route from Washington to Warrenton, Va. In South Carolina the Calhoun Highway will further perpetuate the name of the great Carolinian, while in the North the Daniel Webster Highway connecting New Hampshire and Massachusetts, the State of Webster's birth and that of his adoption, has recently been opened with some ceremony.

"AUTOMOBILE COURTESY"

Automobiles in all parts of the United States will soon be bearing on their windshields a little green and white sticker with "Automobile Courtesy" in large letters over the name of the local automobile club indicating that the driver of this car is observing the courtesy campaign being conducted by the American Automobile Association in connection with the Chicago Automobile Trade Association and the National Automobile Dealers Association.

"We believe that 50% of the automobile accidents which happen on the highways of the United States could be avoided through the use of a little automobile courtesy," said D. H. Lewis, acting executive chairman of the A. A. A. "Courtesy costs nothing and brings greater results than any other element entering into the driving of an automobile.

"Real automobile courtesy demands that we give the other fellow his share of the road; that we dim our lights when meeting another car at night; that we recognize the fact that the man behind us blowing for the road wants to get by and is not challenging us to a race; in short it means being agreeable in all these little things that go so far toward avoiding friction."

The American Automobile Association in taking up with its three hundred affiliated clubs the question of carrying on this campaign is impressing the need for careful observance of traffic regulations as one of the elements of a courtesy campaign. The traffic officer, the Association points out, is only a human being placed in a difficult position because of the necessity of enforcing these regulations and a little courtesy toward him will eliminate many of the more trivial arrests that now clutter up our traffic courts.

THE FEDERAL HIGHWAY ACT

Federal and state engineers are now mapping out a system of highways to serve the whole country. The Federal Highway Act requires that all federal aid be spent on a connected system of highways consisting of not more than 7 per cent of the road mileage in each state and that this system shall consist of interstate or primary roads and intercounty or secondary roads. Proposed systems have been received by the Bureau of Public Roads from all but eight states. They are plotted on a large map and carefully examined as to the coordination of systems of adjacent states and service to all sections of the whole country. Where coordination is not satisfactory conferences are held with all interested state highway officials and routes adjusted and many states have already adjusted difficult problems with their neighbors. Since the Federal Highway Act of last November became a law, only roads certain to be on the system have been approved for construction. It is estimated that the system will comprise 180,000 miles of road 60,000 of which is already constructed.

NORTH CAROLINA RECEIVES BIDS FOR $4,600,000 ON ROAD CONSTRUCTION

What is believed to be one of the largest lettings of state highway construction ever offered by a state highway department in a single day occured on August 30th when the North Carolina State Highway Commission received bids for the construction of 197 miles of state highways, estimated to cost over $4,600,000.

About 120 miles are of standard plain or reinforced concrete, or asphaltic types of paving, and 68 miles are of topsoil, sand-clay or gravel construction.

I. C. C. PERMITS USE OF OPEN-TOP CARS FOR MOVEMENTS OF ROAD MATERIALS

The Interstate Commerce Commission, Service Order No. 23, has been amended to permit the use of open-top cars for the movement of commodities other than coal. The new amendment to this service will release approximately 34,000 additional open-top cars, which will avoid the practical shut-down of the majority of construction projects that confronted the construction industry.

The modification of orders is of the greatest importance to every one interested in construction and especially to all contractors, who now can be reasonably certain of the delivery of necessary materials for their various jobs.

CALIFORNIA TO SPEND $65,000,000 ON ROADS IN FIVE YEARS

It is estimated that $65,000,000 will be required for the maintenance and reconstruction of California highways during the five years, 1923 to 1927, says a recent announcement made by the California Highway Commission. The huge sum is divided as follows:

General maintenance of from 3500 mi. in 1923 to 5000 mi. in 1927 of highway at $2,500,000 a year—$12,500,000.

Purchase of maintenance equipment and maintenance yards at $100,000 a year—$500,000.

Reconstruction and major repairs to old pavement base prior to widening and thickening and other major specific repairs at $1,000,000 a year—$5,000,000.

Improvement on more than 900 mi. of special act roads not included in bond issues and for which no special fund is available, at $200,00 a year—$1,000,000.

Reconstruction of old macadam roads taken over or to be taken over from counties, as well as reconstruction of old bridges, 270 mi.—$8,000,000.

Widening and thickening all main line roads to a minimum width of 20 ft., with the construction of cement concrete shoulders an dasphaltic concrete or cement concrete surface, $1,400 mi.—$33,000,000.

Separation of grade crossings—$5,000,000.

The Missouri Highway Department gives the total number of miles of hard-surfaced roads, within that state as 4,207 mi., as follows: Gravel macadam, 3,898 mi.; bituminous macadam, 175 mi.; concrete and brick, 134 mi.

COLORADO HIGHWAY DEPARTMENT REPORTS ON UNIT PRICES IN 1921-22

An analysis of the unit prices bid on the work of the Colorado State Highway Department during the eighteen months' period from January 1, 1921, to July 1, 1922, has recently been prepared by J. S. Means, office engineer for the Department. The figures which are presented below are based upon some fifty Federal Aid and State Projects in 1921, and nearly as many more during the first six months of 1922. These projects represent only the largest pieces of construction and do not include the numerous small State and bond projects which are carried on directly by the counties or by force account.

	Average Unit Prices		
Unit	1st Six Months 1921	Last six Months 1921	1st six months 1922
Excavation, Com., cu. yd......	.68	.58	.55
Excavation, Solid Rock, cu. yd	1.82	1.44	1.38
Borrow Fill, cu. yd............	.65	.56	.50
Gravel Surfacing, cu. yd.......	2.58	2.01	1.92
Concrete, Class "A," cu. yd...	28,36	24.30	21.49
Concrete, Class "B," cu. yd...	26.80	23.10	20.62
Cement Concrete Pavement, sq. yd.	2.74	2.64	2.46
Reinforcements, lbs.	.10	.08	.06
Structural Steels, lbs.........	.107	.075	.067
Corrugated Metal Pipe (15″), lin. ft.	2.54	1.99	1.88
Timber, Untreated, ft. B. M....	80.00	62.44	62.43
Piling, Untreated, lin. ft.......	1.45	1.31	.93

It must be understood that the prices given are average unit prices and that the prices of the successful bidder were often considerably lower. For the purpose of comparison, however, the average is the only fair basis, since it is common for bids on a single item to vary several hundred to a thousand per cent due to the unbalanced condition of many of the proposals presented.

Considering only the above items which are representative, and the ones which appear in most projects, it will be seen that the unit prices show a reduction of 25.8% between the first six months of 1921 and the same period of 1922, which in view of the quantity of work contracted during the last six months period represents a saving to the taxpayers of approximately three hundred and forty thousand dollars ($340,000.00).

Prices are still showing a slight decline as indicated on proposals received since July 1st, but as a whole they are becoming more stable and little further reduction is looked for in the immediate future.

MONTANA LEADS MOUNTAIN STATES IN ROAD BUILDING

The state of Montana leads all others in the intermountain group in the matter of federal aid projects completed, according to a report made by the Bureau of Public Roads. Idaho takes second place in this respect, and Wyoming third. A total of 4445.5 miles of federal aid projects had been completed by the state prior to March 31 of this year. Idaho has completed 410.1 miles and Wyoming 371.7 miles.

MINIATURE BRIDGE TO AID ENGINEERS SOLVE PROBLEMS

A model of a reinforced concrete arch bridge 7 ft. long has been contructed by the U. S. Bureau of Public Roads to determine just how masonry arch bridges should be designed when built on a skew. A skew bridge is one in which the roadway is not perpendicular to the abutments, as when a bridge crosses a stream diagonally.

It has been found that the stresses in a skewed bridge are considerably different from those in a bridge of the same span built perpendicular to the abutments, and failures have occurred because this was not taken into account in the design.

The problem is so complicated that engineers of the bureau wish to check up their theoretical conclusions by making a faithful reproduction of a bridge, using similar materials and of such size that it can be tested in the laboratory.

Loads will be applied to the model, and the stresses at various places calculated from measurements of the lengthening and shortening of the concrete surface taken with very precise instruments as well as by other methods.

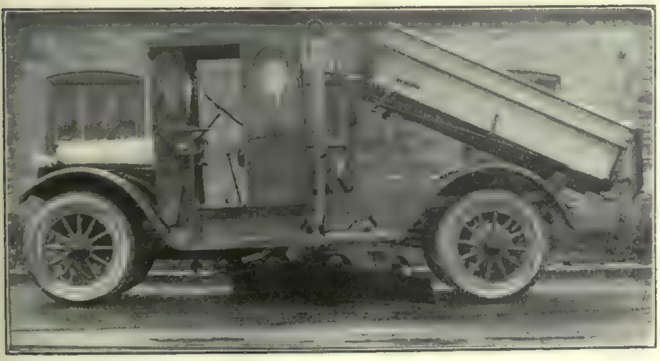
CHICAGO FOREST PRESERVE TO SPEND $2,000,000

A bond issue of $2,000,000 recently placed by the Forest Preserve District of Cook County for the purchase of land, will also provide, according to recent advices, for the construction of roads (concrete and tarred macadam), bridges, sewers and water mains. The construction program has not been completed as yet, and most of the work now in hand consists in building shelter houses and comfort stations. Daniel Ryan is president of the District, and E. J. Flavin in the chief engineer.

Equipment — Trade — Materials

REO SPEED WAGON FOR ROAD MAINTENANCE

The illustration below shows a road floater attached to a Reo speed wagon which will replace up to six teams of horses in doing this class of work. Its greatest efficiency in handling gravel is at a speed of from 10 to 15 mi. p. h. At this speed it spreads the gravel more evenly, fills up all the little cups and ruts and it cannot be equalled in maintaining an ordinary dirt road.



Reo Speed Wagon

The floater is primarily for gravel roads. It is a resurfacer and by its use the surface of the road can be saved in its entirety—the original crown can be perfectly maintained. The flooter fills rather than cuts, which resurfaces by the addition of loose material that has worked out to the edge instead of trimming down the surface and throwing the surplus out, which in itself wears the road down.

NEW EQUIPMENT LEASE ISSUED

A new equipment lease that constructors are willing to sign as either lessee or lessor has just been issued by the Associated General Contractors of America. Its object is to establish on a basis of common equity those obligations and responsibilities properly involved in renting construction machines, and to provide a simplified rental agreement which will insure absolute fairness to both parties.

The form adopted is the result of investigations and criticism of members of the Association extending over a period of two years. It was prepared under the direction of the Committee on Methods, A. P. Greensfelder, Secretary of the Fruin-Colnon Contracting Co., St. Louis, Chairman, and Ward P. Christie, Research Engineer, and through its use it is believed that many difficulties incident to renting construction equipment can be eliminated.

The standard form is arranged so that all blank spaces for filling in of dates, rental rates and other stipulations are segregated on the front of a single sheet, and those provisions of general application and requiring no filling in for ordinary conditions are segregated on the back. Thus a concise form of letter size for filing is afforded.

Copies may be obtained from the Associated General Contractors of America, 1038 Munsey Building, Washington, D. C., or through the secretaries of associated organizations.

AUSTIN ISSUES VALUABLE FOLDER

The Austin Machinery Corporation of Chicago has recently issued a road equipment booklet which will be illustrated by means of pictures of considerable interest to road contractors. It shows three ways of handling a highway extension project, each depicting the full complement of equipment and machinery necessary. It is printed in colors.

INDIANIA TO TEST EMULSIFIED ASPHALT PAVEMENT

For the first time in its history the Indiania State Highway Commission is testing a section of emulsified asphalt pavement on one of the principal state highways. In the event that it holds up in the manner many claim it will, there is much likelihood, according to the Director of the Highway Commission, that emulsified asphalt will be considered in future paving projects.

The section in question is 2.9 miles on State Road No. 22, the Indianapolis, Martinsville and Bedford route. It is in Marion County between Valley Mills and West Newton, and as this is an important road in the state road system, will necessarily be subjected to heavy traffic.

The emulsified asphalt is spread over a width of 16 ft., and there is a 2 ft. stone shoulder on either side giving a 20 ft. roadway. Specifications called for 2 in. of asphalt surface, but the contractor was exceedingly cooperative with the commission and in places spread the asphalt to a depth of 6 in. in order to make a perfect grade. One mile of the asphalt is laid on gravel, and the remainder is on stone. The road cost approximately $29,000.

MICHIGAN ROADS TOTAL 71,500 MILES

Frank S. Rogers, State Highway Commissioner of Michigan, recently made public the following condensed compilation of the mileage of various types of roads in Michigan and the amounts of money involved in their construction:

Michigan has approximately 300 mi. of paved trunk lines; 8985 mi. of macadam and gravel roads; 3550 mi. of primary roads and 6195 mi. of secondary roads; a total mileage of all classes of roads of about 71,500.

Of the $10,210,817.95 Federal Aid proportioned this state from 1916 to 1921, including November, 1921, appropriation; $5,250,000 of Federal Aid funds expended or under contract to December 31, 1921; $3,248,300 under contract, advertised or approved to May 15, 1922, for 1922; $59,675,000 expended by Michigan for highway construction January 1, 1916, to December 31, 1921; $10,000,000 appropriated by State for 1922, making the total of $30,000,000 thus far drawn on the $50,000,000 bond issue authorized four years ago.

PACIFIC HIGHWAY PAVED 27 FT. WIDE

A portion of the Pacific Highway extending 4.9 miles to the north from the city limits of Seattle, Wash., is being paved with concrete 8 in. thick and 27 ft. wide. The work is being done by the Washington Department of Public Works, Division of Highways, and is one of those projects on which federal aid funds are used. The paving is being placed in two 13½ ft. sections with a ⅜-in. expansion joint between. The work is to be completed this fall at a total cost of about $46,800 per mile.

CONSTRUCTION OF CONCRETE ROADS

(*Continued from Page* 84)

of all others, he can exploit his position for his personal profit, a condition that means increased costs of construction.

Good Workmanship Essential

Good workmanship must go hand in hand with good materials. The one is just as essential as the other to a good job. We have developed a system of carrying on and finishing our work that has eliminated the personal equation to a large extent. Each contractor is required to furnish a definite set of tools designed by the state and to use them in a certain prescribed manner. Each workman is thereby given the benefit of the experience of all by being supplied with tools and instructions from our engineers and they secure a first class job.

The specifications covering the details of materials and construction are quite thoroughly developed, and, under competent engineers, are getting good results. From a layman's point of view and from an administrative point of view, the thing to do is to secure the services of competent engineers and then to back them up. Specifications are only as good as the inspection. Furthermore, no matter how good the specifications, their value to the work is measured by the loyalty, intelligence, and judgment of the engineers and inspectors in charge of the work and the support given them by public officials and the public at large.

The Maryland State Roads Commission plans to spend $4,800,000 this year, $3,000,000 for construction of improved highways and $1,800,000 for maintenance of the existing system.

PERSONAL MENTION

Burroughs, P. E., district engineer of the State Road Commission of Maryland, has resigned and is now associated with the D. A. Hanneman Construction Company of Salisbury.

Eby, Earl H., formerly district engineer with the South Dakota Highway Commission, has been promoted to the position of construction engineer with headquarters at Pierre.

Schrader, F. H., formerly resident engineer with the South Dakota Highway Commission, has been made a district engineer and will be stationed at Brookings.

Padgett, J. M., until recently a foreman with the Weller Construction Co., road builders of Washington, D. C., has joined the staff of the Pottsville Construction Co., Grampian, Pa.

Henry, D. E., senior engineer of the U. S. Bureau of Roads for the Southwest, has resigned to accept a place with the California Highway Department.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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TABLE OF CONTENTS

The Merits of Bar Reinforcement for Concrete Pavement 91
By W. S. Edge

The Artistic Design of Bridges 93
By Charles Evan Fowler

The Elimination of Traffic Hazards in Highway Improvement 95
By Arthur H. Blanchard

EDITORIALS AND NEWS

The Influence of Good Roads 96
Highway Department Stages Instructive Exhibition 96
Increasing the National Wealth 96
Road Construction in Pennsylvania 96
New Method of Paving Bridge Floors 97
Canada Spends $50,000,000 on Highways . . 97
Philadelphia Builds 94 Miles of New Streets . 97
Many Fine New Roads in New Jersey 97
Good Roads Saves Gasoline 97
Deterioration of Concrete 98
State Owns General Plant 98

PERSONAL MENTION 98

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII SEPTEMBER 13, 1922 No. 11

The Merits of Bar Reinforcement for Concrete Pavements

By W. S. EDGE

Concrete Steel Company.

THE subject of bar reinforcement for concrete pavements is one that has occupied a good deal of my time for the past three years. My company has been interested in the matter to the extent that they desired to find out whether concrete pavements needed reinforcement and if so what was the best type and the proper amount of steel to use for this purpose. In other words that was my job. Please do not think that I pose as an expert who will tell you the correct solution of this whole matter, but rather as one who is studying the great problem with a view of determining the best way of doing the job in the most economical manner possible.

Use of Deformed Bars

My interests have been mainly directed heretofore along the lines of reinforced concrete building construction and similar heavy structures of reinforced concrete. In the early days of this industry there was a great deal of both woven and welded mesh used for reinforcement particularly for floor slabs where large areas were employed. We soon found, however, that a deformed bar reinforcement could be substituted with marked economy, particularly where heavy reinforcement was required. It has become almost the universal practice in the building world, therefore, to use deformed bars, and with the advent of more rigid specifications, various types of supporting and tying devices space and support the steel have come into use. We still use mesh in certain kinds of pipe and sewer work where it has advantages and also for light shrinkage reinforcement in buildings over so-called joist construction. It is also used in New York City in combination with skeleton steel construction and cinder concrete arches where an archaic building code allows this type of reinforcement certain advantages. With our past experience it was perfectly natural that we should expect to find an economy in the use of deformed bars in concrete road construction and such we have found to be usually the case where a reinforcement of 40 lb. weight per 100 sq. ft. or greater is required. A deformed or plain steel bar is one of the very cheapest forms into which the metal can be rolled and that in a measure, explains its now.well night universal use in reinforced concrete construction

In the course of our experience with reinforced concrete buildings and other reinforced concrete structures we have developd numerous special devices which, in certain classes of work have effected marked economies in assembling steel reinforcement. In every case their use has produced a better and more workmanlike job and where there was much repetition of similar arrangement of reinforcing elements remarkable economics have been secured.

Standard Bar Reinforcement

We experimented with various methods of introducing steel bars into a road and soon reached the conclusion that no method of placing loose bars could be anything but a nuisance and a delay to the construction. The road contractors were particularly outspoken against any form of loose bar reinforcement; in fact the mere mention of it was sufficient to start something. We, therefore, have standardized on the assembly of bar reinforcement into units or mats, the sizes of which depends upon the manner in which the construction is to be handled. Ordinarily they are made either the full or half width of the road and from 8 to 14 ft. long. The matter of length being decided by the type of equipment employed by the contractor; for example, if he is using a boom and bucket a length as great as 14 ft. may be adopted and if he is using a chute he may not wish to pour more than eight feet at a time.

The first road work with which we had anything to do where bar reinforcement was employed was at East Brookfield, Mass., on a State Road job on which Bianchi and Co. were contractors. Many of the details of this

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Abstract of a paper presented at the 1922 Convention of the New Jersey Highway Association.

work were worked out by the State Engineers of the Massachusetts State Highway Department and the engineer of the contractors. We sold the steel, but otherwise were more observers than directors of this operation.

The reinforcement consisted of quite heavy bars ½ in. square, spaced about 2 ft. apart transversely and concentrated longitudinally near the edge and centre of the road. These mats were 9 ft. 8 in. by 14 ft., one-half of the 20 ft. road being built at a time. For a mat of this type it is possible to build the assembly frame waist high since all the tys can be made from the outside.. The fabrication was a comparatively simple operation. The bars in bundles were distributed along the right of way so that a pre-determined number of units could be made up at any given point. The assembly frame was very light and was easily carried by two men from one point to the next. The bundles of bars were cut open and the bars placed in the frame, only three lengths of bars being used on this work. Then they were tied at all intersections and the assembled units were piled along side the road. Two men easily kept ahead of the work and did not have to work steadily either and the contractor averaged about 410 lineal ft. of 10 ft. width of road a day. The specifications called for bottom reinforcement and the mat of bars was placed directly upon three pipe supports which were pulled out as the concrete came in.

The contractor was well pleased with the progress made on this work and informed me that the use of the reinforcing steel did not retard his progress noticeably. Dowels were used on this work across the longitudinal centre joint. The road being constructed half at a time, these dowels were bent at right angles when placed in the first section and were later straightened, but not at the exact point of bend. The idea being to provide a certain amount of flexibility at this joint.

Type of Construction in New Jersey

In New Jersey through the courtesy of the Highway Department, two roads were built in which a top and bottom reinforcement composed of deformed bars was substituted for two layers of mesh which was originally specified. It seemed to me that here was a case where a large economy was bound to result to the contractor in the simplified construction. With the use of fabric he would have to level off about 2 in. of concrete and then place the bottom reinforcement, then run more concrete striking off within 2 in. of the top, then place his upper layer and finally finish the section. With bar reinforcement his construction operations are reduced to placing the unit or cage of steel and concreting his entire section at once. The design of this reinforcement was made in our office in about five minutes and is far from ideal and we think we have been able to improve on it in several respects, but it served its purpose and so far as I know was satisfactory to all concerned. The cost of making the mats up in the field and tieing them, altogether proved to be not over one cent a sq. yd. of single mat or two cents a sq. yd. of road.

The methods used on the West Portal job are similar to those used on earlier jobs with the exception that the necessity of tieing the centre of the mats made a 14-in. frame from the ground necessary. The addition of structural angles on the top of the frame also made assembly easier and more rapid. Two men fabricating easily kept ahead of the work and I understand took a sub-contract at one cent per sq. yd. of mat for fabrication. I have heard many favorable comments on this work, but I have also heard some criticism of minor details. Personally I do not like the method of supporting from the subgrade nor do I consider the reinforcement sufficiently rigid in itself so that our efforts have been directed toward making improvements in the reinforcement without increasing the cost.

We have always taken the attitude that it was not our function to design the road reinforcement, but that when the highway engineer told us what he wanted then we would be glad to make suggestions as to the best method of carrying out his wishes in a practical way, always with a view to providing an economical construction.

The Result of Research

During the past year I have spent a great deal of time with highway engineers from North Carolina to Maine and as far west as Illinois, and as a result of my very pleasant friendship and discussions it seems to me that the researches of Mr. A. T. Goldbeck at Washington, D. C., and of Mr. Clifford Older at Springfield, Ill., stand out above the other investigation work that has been done and form really a large advance toward the solution of this question.

Without going into great detail with regard to these experiments which would form sufficient material for a volume, perhaps the following points are worth attention. A concrete slab plain or reinforced works due to temperature changes, lifting in the centre in the middle of a warm day and lifting at the edges at night. This action is especially marked with an 18 or 20 ft. slab and will cause its failure by a longitudinal crack near the centre. The weakest portion of the slab seems to be the corners at transverse joints and at the centre. Unless the subgrade is bad, the stresses in the under side of the slab do not seem to be serious in a 20 ft. road where a center longitudinal joint is used. The dowelling of the slabs together longitudinally and stiffening the edges of the slabs is highly important and transverse reinforcement in the top of the slab is absolutely necessary.

To meet these conditions as we believe them to exist we have developed a design which was shown for the first time at the Chicago Good Roads Show. This caused so much interest that we are encouraged to recommend it for all concrete roads where conditions justify its use. This unit is designed to rest directly on the sub-grade being supported along the edges on the ends of the hooked transverse rods and at the 1-3 points by the truss support bars. It can be collapsed flat for piling and transporting it desired.

The cost of fabrication is only slightly greater than that of a plain mat of the same size and the same number of ties. It can be made either upside down or right side up in the assembling frame. One would naturally think that there would be a tendency for this unit to collapse in use, but such has not proved to be the case; as a matter of fact the first unit of this type that we built successfully resisted the efforts of 4 men to collapse it. Certain changes in the tying were necessary to produce the desired result. The combination of deformed bars and spring wire bar ties gives exactly the action we desire, i. e. a yielding yet powerful spring grip which will allow the bar to be rotated but will not allow either bar to slip under normal usage.

Considering the details of design, our main reinforcement is transverse near the top of the slab with a concentration of longitudinal steel near the edges and centre of the road where it is most needed. The truss bars are not counted as full reinforcement because parts of them which touch the ground will undoubtedly rust out in the course of time. So far we have found no other method of support which is equally satisfactory that does not cost more than this and besides, anything in the nature of chairs or auxiliary supports would be a nuisance and just one thing more the contractor would have to bother with.

The cost of this type to the contractor will be about the same or less than mesh or fabric at present prices from 56 lb. per 100 sq. ft. and up. There are certain factors that must be borne in mind, however. We use preferably ⅜ in. round bars, although in the heavier weights ½ in. round or square bars may be employed.

The Artistic Design of Bridges

By CHARLES EVAN FOWLER

Chief Engineer, Detroit-Windsor Bridge.

THE use of such a title for this brief article, as is usual in similar discussions, "The Architecture of Bridges," would seem to the writer to point to a misconception of the real problem. There is as yet no architecture of bridges and it is doubtful if there ever will be any system of hard and fast rules to govern their artistic design.

There are, however, certain fundamental principles and certain elements of design which must be observed, if we are to arrive at a pleasing ensemble for any particular structure. The problem is much more simple if we are designing a stone arch bridge, or one of concrete, or one of reinforced concrete, than is the case when designing a steel span or series of such spans. However, there are certain basic principles that apply to any and every type of bridge.

Simplicity, Harmony, Symmetry and Proportion must be regarded in any design that would have any pretentions to beauty or artistic effect. They are fundamentals of true architecture or artistic design, no matter what the structure may be to which thought is to be applied in its design.

Simplicity means first a truth-telling structure, no subterfuges about the lines of stress, no covering of a concrete structure with a stone facing, no frivolous or inappropriate details, but a strict adherence to the necessary features, whether they are to carry the loads or to ornament the bridge.

Harmony is essential to a pleasing or artistic design, for without it the structure would be distasteful. Harmony not only as between substructure and the superstructure; between the various spans; between the spans and approaches; between the utilitarian features and the ornamental details, but with the surroundings as well.

Symmetry may or may not be essential to a pleasing design, although it usually is necessary if a truly artistic structure is to result. Where the bridge has great length, unsymmetrical features are not so notireable as in a shorter one, which may all be seen at a glance. As is often true in a landscape, balance must often be secured by including an unsymmetrical feature. That is, wherein one portion of a structure, a draw span or other unbalanced feature must be included that will destroy the symmetry, something must be introduced in another portion that will restore the balance, although symmetry does not result.

Proportion is necessary, that the three preceding principles may be realized, and usually, but not always, when the economical proportions have been determined, they are pleasing. However, in many cases modifications must be made to reach the point where economy and beauty can both be satisfied. Proportions of the details employed for ornamentation is quite another thing, and to be harmonious they must also be properly proportioned.

Examples may be seen in almost every structure of the power application of some of these principles, but more often do we find most of them flagrantly violated. The remark made by C. Shaler Smith, the dean of American bridge engineers, to one of his assistants—"Most bridges are examples of what not to do"—must be remembered by anyone who wishes to attain to high rank in his profession. It is to be feared that in most cases we feel that, "in the long run, the average sense of the many is better for the many than the best sense of any

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Abstract of an address, delivered before the Civil Club, of the University of Toronto, March, 1922.

one man." There is a right and a wrong; most engineers attain neither, in the hope they are right and the fear they are wrong.

Pleasing Ensemble Vital

We need not care whether a detail is Byzantine, Greek, Roman, Gothic, or Renaissance if it is of the proper proportion, harmonizes with the other details, with the structure, and helps in forming an entirely pleasing ensemble. The Gothic arch was Persian before it was Gothic. Our structure may be similar to a work of architecture, in that it is neo-classic, but who would say that for this reason the Rathhaus of Cologne, or the Hotel de Ville in Antwerp, are not good pieces of art?

The diagonals or latticing in a bridge are sometimes unpleasing, and at other times in some other structures, not unpleasing. They probably originated with the savage, who used vines or fibre to form diagonals for his primitive structures. The farmer of today still uses ropes or wire for similar purposes, but as yet diagonal bridge members, nor yet the garden trellis, have been accorded a niche among architectural styles. The engineer, for some scores of years, has calculated his diagonals, and used them in his design because he believed they were necessary, no matter how incongruous they appeared. Now we know how to provide for secondary stresses and can often omit the diagonals whenever a more pleasing structure will result.

Ornamentation

The curved lines of the suspension bridge and of the arch are inherently beautified, and simplicity is best illustrated in its pleasantest features in bridges of this type with no decorations or embellishments of any kind. However, we must not overlook the fact that even a chaste design may be much improved in appearance by the use or addition of appropriate and harmonious details or decorations. The suspension bridge seems sadly designed where the towers are not properly completed by a parapet or attic storey for those of stone, and perhaps crestings for those of steel. The arch is made more beautiful by molded work in the arch ring, by the use of appropriate medallions at the key stone, by the careful embellishment of the spandrels or spandrel arches, and lastly by the use of well designed and ornamented parapets and parapet railings.

Harmony is best exhibited where no part of a structure or of its decorations seem to be extraneous, and where the structure harmonizes with its surroundings. This latter feature is illustrated by the harmony of the battlemented towers of the Conway suspension bridge and the Conway tubular bridge, with Conway castle; by the medieval towers of the London Tower Bridge with the Tower of London; and by the harmony of the stone towers of the old Brooklyn bridge with the high buildings of New York City, although this is but a happy accident, as the buildings were the later development.

Symmetry

Symmetry in its simplest form is where one-half of the structure is exactly like the other half, where one approach is like the one at the other end of the bridge. That is where the structure is perfectly balanced in the simplest manner. The most pleasing design is where the centre of the bridge is at the centre of the middle span, or it may be stated as a fundamental principle that an artistic bridge must have an unequal number of spans—one, three, five, or seven in number; but beyond seven spans the eye does not so readily grasp the whole and seek for an opening instead of a pier at the centre. Likewise the spandrel arches of an arch bridge must be three, five, or seven in each half of the span, or where they extend across the key stone, an unequal number for the whole span.

Proportion is most nearly reached when the whole structure is most pleasing to the trained eye, and the truth most closely adhered to in every part of the structure and in every detail. The use of too great a sag in a suspension bridge, or of too great a rise in an arch bridge dwarfs the apparent length of ssch a span. That is, too great for appearance, even if not too great for economy.

Careful Study Needed

We must remember that there is nothing really in common between the architecture of buildings and the artistic design of bridges. The lack of any attempt at artistic design in the Williamsburg suspension bridge is deplorable; the failure to complete the towers of the Brooklyn Bridge is deplorable; the attempt at an artistic design for the Manhattan Bridge produced a structure which is only not unpleasing; but in the Hell Gate arch we have a structure which is of great simplicity, of real harmony, of true symmetry, and perfect in proportion. It is not often given to man or to the engineer, to attain nearly to perfection, seldom more than once; but by careful study and thought, we can obviate very many flagrant violations of the artistic in the design of our bridge structures.

PARIS INAUGURATES BIG STREET PROGRAM

The municipal authorities of Paris, France, have begun carrying out a vast program of street improvements authorized some time ago. The sum of 11,500,000 francs is being spent for the transformation of stone paving into asphalt paving with more money to be expended later. Among the streets to be improved are the Grand Boulevards, Rue de Rivoli, Rue Montmarte, Rue de LaFayette, Avenue du Bois de Boulogne, Place de la Concorde, Boulevard Malesherbes, Avenue des Champs Elysees, Place Verdome, Place de L' Etoile and a score of others more or less familiar to thousands of tourists.

The Elimination of Traffic Hazards in Highway Improvement

By ARTHUR H. BLANCHARD

President National Highway Traffic Association

AN intimate relationship exists between the elimination of traffic hazards and the efficient design, construction and maintenance of highways. A momentous responsibility rests on federal, state, county and municipal highway engineers to constantly realize the public duty which is imposed upon them to safeguard to the maximum extent the life and property of persons using highways.

Methods to Relieve Congestion Should be Studied

In the field of municipal highway improvement, more attention should be concentrated on methods to relieve congestion of traffic on city streets. The construction of ample widths of roadways, arterial diagonal streets and circumferential streets will materially assist in the relief of congestion of main traffic and business streets in many cities. State and municipal highway officials should cooperate in the routing of through traffic around the business sections of large cities and even outside the limits of small municipalities. Marked relief from traffic congestion has resulted wherever this fundamental principle of city and town planning has been adopted. A detail of street construction, often overlooked in many municipalities, which materially aids in the safe use of streets is the construction of motor vehicles, in turning right-hand corners, to encroach upon the left-hand side of the roadway is materially reduced. State and county highway engineers may by proper highway design, construction and maintenance eliminate or measurably reduce many traffic hazards.

Widths of roadways should be constructed which will allow the safe passage of all classes of vehicles utilizing a given highway. For a two-lane state trunk highway, the paved width should not be less than 18 or 20 ft., depending upon the traffic to which the highway will be subjected. Serious congestion is resulting on many trunk highways due to the temporary parking of motor vehicles undergoing repairs or stopping for brief intervals. These obstructions on the roadway may be obviated by the construction of 5-ft. shoulders of sufficient strength to carry standing vehicles. Cases have been noted where five vehicles within a distance of one mile on a highway outside of a municipality have been parked on the roadway undergoing repairs. This practice at night, especially in the case of a vehicle without a tail light, constitutes a serious source of danger. On narrow roadways, 14 to 17 ft. in width, the safety of the traveling public may be increased by the marking of a center line on the pavement surface. Where traffic demands a greater width than a two-lane highway, the construction of a four-lane highway of 36 to 40 ft. in width is recommended. The construction of three-lane highways should not be required as under no practicable traffic regulations is it feasible to safeguard travel on the center lane of travel.

Traffic hazards on curves may be materially reduced by constructing the curves with a long radius, banking the roadway of the curves, constructing an extra width of the pavement on the inside of the curves, marking a center line on the pavements and eliminating obstructions to view on the inside of the curves. Right angle corners within distances of each other of less than 500 ft. exist in many localities. These may be classified as ultra-dangerous traffic hazards and should be eliminated by the construction of a long double reverse curve in place of the two sharp curves and the intervening short straight stretch of roadway.

In many cases, hill crests on highways constitute as serious traffic hazards as sharp curves on level stretches of highways. The tendency of many motorists to travel in the center of the roadway when no approaching traffic is observed has caused many accidents at crests. A center line marked on the pavement over the crest materially reduces this traffic hazard. It is believed that the expense of placing danger signs, calling attention to this hazard, on the sides of the roadways approaching all dangerous crests would be justified.

Reducing Accidents at the Railroad Grade Crossing

Railroad grade crossings are a constant source of accidents. It is evident that their total elimination is desirable, but unfortunately is not practicable in all cases in the present state of the financing of highway improvements. Each can be done by proper design to reduce traffic hazards in the case of railroads crossing highways at grade. A clear sight of the railroad crossing for 500 ft .on each side should be provided and a clear sight of the railroad for a 1000 ft. on each side of the highway is desirable. The width of all roadways crossing railroads should be at least 20 ft. For a distance of 100 ft. on each side of the railroad, the grade of the highway should be level or not over 2 ft. rise or fall in 100 ft. The suggestion by some officials to construct humps in the highway to slow down traffic approaching railroad crossing is unreservedly characterized as per-

(Concluded on Page 98)

Presented at the Congress of the National Safety Council, Detroit, Mich., August 30, 1922.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. L. POWERS, Editor
E. W. TREE, Managing Editor

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THE INFLUENCE OF GOOD ROADS

That Federal aid for highway building partakes of the nature of a contribution from the richer states to those of lesser wealth and that under the present system some states gain while others suffer, is a fallacy which can easily be disproved by an understanding of the sources from which the funds are derived and the benefits from the roads built, says a bulletin issued by the American Highway Educational Bureau.

The income of the federal government comes almost wholly from three sources—internal revenue, postal receipts, and customs revenues. The miscellaneous receipts and revenues from other sources constitute a very small percentage of the total. All of these major revenues are of a character which cannot be properly confined or allocated by states. The fact that these revenues are collected within certain states is not indicative of the source of production of the basic wealth which makes them possible.

It cannot be said that any definite part of federal-aid funds comes from any particular states, and it is beginning to be generally understood that the benefits from good roads in any state are by no means confined to the boundaries of the state.

A manufacturing state consumes food from agricultural states and is bound to benefit from good roads which enable the farmer to deliver his product at the railroad station at a lower price, and in addition the farmer will be more prosperous and buy more from the manufacturing states. On the other hand, good roads in the manufacturing state result in cheaper delivery of materials and transfer from one plant to another and consequently cheaper prices to the farmer

With our complex civilization it is impossible to trace all the benefits of one good road. There is no doubt that a national system of roads is needed, that progress to this end is far ahead of what it would have been without federal aid, and that the benefits to any state greatly exceed their share of the cost, on whatever basis it may be figured.

HIGHWAY DEPARTMENT STAGES INSTRUCTIVE EXHIBIT

Visitors at the Minnesota State Fair were afforded an opportunity to see an instructive and interesting exhibit displayed by the State Highway Department, showing concisely and effectively by graphs, models and pictures just what the department is accomplishing for Minnesota. Charts on a gigantic scale displayed the extent of the highway operations, and a great map portrayed what has been accomplished in the way of building permanently on the 7,000 mi. state trunk line system. Moving pictures taken in various parts of the state showed road building operations, and modeled sections of highways, bridges and culverts offered an object lesson displaying approved engineering methods in road construction with various materials.

A truck driver to beat a train to a crossing at Annandale recently, caused a wreck in which more than fifty people were killed and injured and thousands of dollars worth of property ruined. When will the public learn to use caution in approaching a grade crossing?—*Waseca Herald.*

INCREASING THE NATIONAL WEALTH

Returns compiled by the Canadian Department of Customs indicate a 600 per cent. increase of motor traffic into Canada during the last calendar year, the total being 617,285, as compared with 93,300 for the previous year. Of this number 615,074 remained in the Dominion for less than one month and 3,211 for more than one but less than six months. The Parks Branch of the Department of the Interior has calculated that this motor traffic represents an expenditure in Canada of more than $108,000,000 and it is estimated by the same authority that on a basis of 5 per cent. "improved roads are worth over two billion dollars without taking into account the services they render Canadians themselves."

ROAD CONSTRUCTION IN PENNSYLVANIA

During 1919, 1920 and 1921, and up until Sept. 1, 1922, the State Highway Department of Pennsylvania built 1,620 miles of modern-typed roadway. During the same period the operations of the Highway Department's maintenance division also resulted in the entire resurfacing of 1,345 mi. of macadam roadway and repairs to many additional miles. In this work 3,021,169 tons of stone were used—or a quantity sufficient to fill 67,138 steel hopper cars. This is the stone used by the maintenance division only. If all the materials used by the construction forces and the maintenance division could be hauled in a single train that train would be 2,254 miles in length; and when the caboose of this train was passing Harrisburg, Pa., the locomotive would be 373 miles west of Denver, Col.

NEW METHOD OF PAVING BRIDGE FLOORS

In order that the probability of fire on the great Victoria bridge, Montreal, Quebec, might be reduced to a minimum, it was decided in reconstructing the floor, to surface it with two inches of sheet asphalt. In addition to reducing the fire hazard, the maintenance cost, as compared with the old wooden floor, has been greatly reduced. This novel method of treating a bridge floor is proving quite popular in Canada.

To provide for the effect of vibration of the bridge and also for the effect of heavy traffic and weather, an unusually dense mixture of asphalt was adopted, care being taken to lay it with sufficient resiliency to meet the traffic conditions. Consequently, a high percentage of bitumen for plasticity and a maximum amount of filler for stability was specified. After a good deal of experiment it was found that 13 per cent. of asphaltic cement was excessive and finally 11.6 per cent. was adopted. The new bridge floor has now been giving excellent service for two years without additional cost for maintenance.

CANADA SPENDS $50,000,000 ON HIGHWAYS

Fifty million dollars will have been spent on improving Canada's highways, many of which are of the asphaltic or resilient types, when the five-year period terminates in the fall of 1923, according to reports received by A. W. Campbell, Dominion Commissioner of Highways. Of this total $20,000,000 will have been appropriated by the Dominion Government and the remainder by the different provinces of the Dominion sum there is yet $800,000 to be taken up by the provinces.

Alberta, the last province to take part in the Dominion highway scheme, has just filed for approval plans for road improvement under the Canada Highways Act. All of the provinces are now working under the general regulations provided by this act, and the work throughout the provinces is being carried out in accordance with uniform standard specifications.

PHILADELPHIA BUILDS 94 MILES OF NEW STREETS

During the past two years the city of Philadelphia, Pa., has paved 75 miles of streets, principally with asphalt and is rapidly completing 19.5 miles more. The additional 19.5 miles of paving will be laid on 140 streets and avenues in various sections of the city. In Broad Street, Philadelphia has long been recognized as having one of the finest asphalt streets in the country. According to F. C. Dunlap, chief of the Philadelphia Bureau of Highways, an analysis of all the city's sheet asphalt pavements indicated that more than 50 per cent. are over fifteen yars of age and in view of many such records and the city's experience with other types of construction, the bureau has adopted sheet asphalt and granite block as standard types for the most heavily travelled streets. In New York City, paving on all heavy traffic streets now is restricted to sheet asphalt and granite block with asphalt filler. In addition all cuts and openings in the pavement of Fifth Avenue, recognized by engineers as the finest paved thoroughfare in the world, are being repaired with asphaltic concrete base instead of the Portland cement concrete formerly used.

MANY FINE NEW ROADS IN NEW JERSEY

The New Jersey State Highway Department which has long set a pace for other states to follow and whose efficient chief engineer, T. J. Wasser, recently was elected president of the American Road Builders' Association, has let contracts this year for many miles covering the latest and most durable types of pavement. New Jersey contracts let early this season provided for 22.6 miles of new asphalt highways. Roads of this type are being constructed of twenty to thirty feet width, with shoulders, between Smithville and the Mullica River, Eastontown and West Long Branch, and Bridgeton and Millville and in the vicinity of Madison, Bridgeton, Newark, Bound Brook and Passaic.

There are in New Jersey 17,121 miles of roads, of which 6,977 miles have been improved with hard surfaces, such as sheet asphalt, asphaltic concrete, bituminous macadam, Portland cement concrete and other modern pavements. Of the total road mileage 40.7 per cent. is now hard surfaced. The mileage of hard surfaced roads in New Jersey is 7.7 per cent. greater than the percentage for the United States in general. The state also has two and one-half times as many roads per square mile of area as the whole United States.

New Jersey also holds the distinction of being the first state to adopt the policy of state aid with an appropriation of $75,000 in 1891. The state is now spending about $3,500,000 annually for roads and is contemplating a bond issue of $40,000,000 more to be used as state aid in the future. The largest new single road project undertaken by the New Jersey Highway Department this year is the eight mile stretch of asphaltic concrete highway between Bridgeton and Millville.

GOOD ROADS SAVES GASOLINE

The maintenance of good roads throughout Nebraska means a saving to auto drivers of approximately $3,330,000 a year, according to P. E. Clement, field secretary of the Nebraska Good Roads Association. There are about 250,000 automobiles registered in Nebraska. The average annual travel is conservatively estimated at 5,000 miles, or a total of 1,250,000,000 miles. With these cars getting an average of 15 miles on a gallon of gasoline, 83 1-3 million gallons would be the annual consumption of gas in the state. A saving of 4 cents per gallon would mean an annual savving of 3 1-3 million dollars.

Ponca City, Oklahoma, claims that it leads all other cities in the ratio of cars to population, according to the "Oklahoman." It has over 2,500 cars, or on the average more than one car for each family.

Kossuth county, Iowa, specifications for gravel road construction require that the contractor in bidding must include the cost of removing at the pit all stones in the gravel which will not pass a one-inch screen opening. This specification insures that no large stones be left on the surface to add a danger element, or to wear through the surface after the road has been in use some time and form a rough, uneven surface.

DETERIORATION OF CONCRETE

Changes which take place in concrete during its conveyance from the mixer to the place where it is to be used—frequently a considerable distance—deserve careful attention, because a concrete mix possesses special characteristics. It may, for instance, lose strength, and another source of trouble lies in the segregation of the aggregate. This, it has been found, may be prevented in some measure at least by the use of hydrated lime. Recent tests made by the U. S. Bureau of Public Roads indicate that a considerable time may safely be allowed to elapse between mixing and use without appreciable loss of strength. Gravel concrete of 1: 1½: 3 mix was hauled in trucks that the material tested in periods of elapsed time varying from fifteen minutes to three hours and ten minutes. It was found that the average crushing strength of cylinders was very nearly the same for all specimens but that the workability diminished markedly after the first hour. Apparently, the practicability of the method would depend upon workability rather than strength, as after forty-five minutes the mixture was too dry for hand finishing, although it might have been used up to two hours of elapsed time with a pavement finishing machine. It thus appears that so long as concrete is workable after hauling, its strength should be sufficient, and the most practicable way of utilizing concrete hauled from a central mixing plant is to employ a machine finisher.

STATE OWNS GRAVEL PLANT

Nevada has been experimenting for more than a year with a state-owned and state-operated gravel plant located at Lahontan on the Tonopah branch of the Southern Pacific Railroad.

The State Highway Department is operating the plant and it is supplying sand and gravel for highway construction over a considerable territory. Numerous tests were made before the site was selected and at the place chosen about 300,000 tons of gravel were within easy reach of the hopper.

ION OF TRAFFIC HAZARDS

(Concluded from Page 95)

nicious. It is self-evident that the number of accidents due to traffic hazards may be materially reduced by proper danger signs located at 500 ft. from grade crossings, curves, hill crests and important road intersections.

The field of highway maintenance proides many opportunities for reducing traffic hazards. Methods should be employed which will reduce obstructions to traffic to a minimum. Only one specific type of roadway will be mentioned in connection with maintenance. Gravel roads abound in the middle west. Their use is attended to by many accidents which may be materially reduced by proper maintenance. An excessive use of loose gravel has been the cause of many accidents while the traffic hazard of dense clouds of dust is apparent to all who travel gravel roads which have not been so maintained as to eliminate or materially reduce the dust nuisance.

Florida, the mecca of winter tourists, is steadily going ahead with highway improvements which include the widening of the road the elimination of railroad crossings, and straightening of curves on the Dixie Highway between Jacksonville and Miami. Estimates are to the effect that travel over roads in the southern states has increased 500 per cent. in recent years.

PERSONAL MENTION

T. H. Webb testing engineer, has been appointed assistant state highway engineer of Texas to succeed C. H. Kendall, who has resigned.

J. E. Kaulfuss, engineer of the North Dakota State Railway commission, has accepted the secretaryship of the North Dakota Good Roads Association.

J. E. Blair until recently a resident engineer, Texas State Highway Department, is now city engineer of Mineola, Texas.

H. C. Porter has been appointed a Texas State Highway division engineer to succeed James Perie, who resigned to become city engineer of Ballinger, Texas.

D. M. Ferlet, assistant engineer of the Terrell Independent Road District, Terrell, Tex., has been made resident engineer.

A. W. Buford, formerly employed by the U. S. Bureau of Public Roads as highway bridge engineer, has recently been apppointed district engineer by the Arkansas State Highway Department.

D. L. Costello, formerly an inspector of construction in the U. S. Navy, has been made a resident engineer in the Massachusetts Bureau of Highways, Department of Public Works.

R. E. Killmer, recent assistant county engineer of Bexas County, Texas, has been appointed county engineer.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. W. TREE, Managing Editor

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TABLE OF CONTENTS

Establishing a Good Roads Policy 99
By M. A. Lyons

Sheet Fabric Reinforcement for Concrete Pavements . 102
By W. C. Kuhn

Road Material Rate Reduction Upheld 104
Unload the Same Day 104
A Noteworthy Event in Maryland 104
Bid Prices for July 104
Colorado Road Scenes to be Filmed 105
Playtime on American Highways 105
New Roads in Indiana 105
A Concave Concrete Pavement 106
Inundated Sand Investigation 106
Arlington Road Tests Show Progress 106

EQUIPMENT—TRADE—MATERIAL

Heavy Road Grading with a Gas Shovel 107
Proper Use of Dynamite 107

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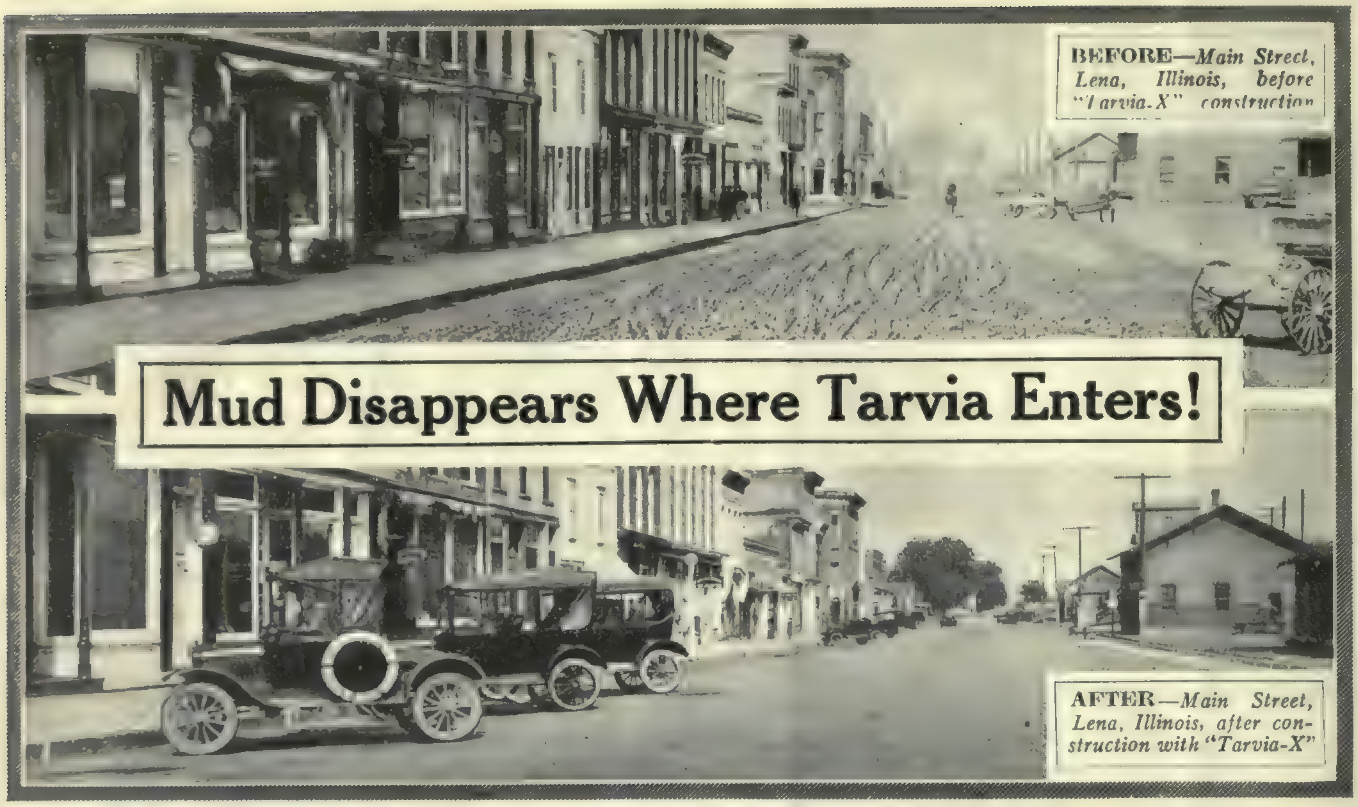

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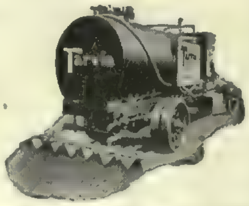

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Establishing a Good Roads Policy

Both Executive and Financial Aspects Must Be Studied if the Highways are to Be Developed to Serve the Nation

By M. A. LYONS

Chief Engineer, Good Roads Board, Province of Manitoba.

THE roads and highways of any county hold a very unique position. They are entirely devoted to, and can be considered only from, the viewpoint of "service." There is no other reason why there should be roads except to serve the public. Railways serve the public, but up to the present they have not been constructed to serve unless there is a hope that they will at least pay their way. Street railways, power systems, telephone systems, water-works and other public utilities are expected to be paid for directly by those who enjoy these utilities; but roads are to be paid for by the public at large and seldom if ever by the people who use them in proportion to services rendered. In considering a road policy we must always keep before us that the whole aim of our policy must be one which will give the greatest value in *service*. This *service* is not for any one group of people,—not for the farmer alone or for the manufacturer; not for the man with a team or the man with the automobile; not for the worker alone or the pleasure seeker; but *service* to all who wish to use the road.

Division Under Which Policy Should Be Considered

The consideration of a road policy falls into two divisions; first, executive; second, financial. Under "executive," we must first consider who will have charge of the roads. Will they be constructed and operated privately or by public bodies. This question has already been answered for us and it seldom enters our mind that they could possibly be operated by private corporations in competition with each other, although if they were operated in some such way our highway system would be in much better shape than it is to-day. It had been determined for us that they are to be under the control of some public body. Of these there are in general three bodies, who are in a position to assume this duty; (first) the Federal Government; (second) the Provincial Government, and (third) the Municipal Government.

In a railway, where the haul is inter-provincial, it is essential that one central body should have control of a complete system. In roads it is not essential that there should be one central body in control throughout the Dominion. Freight hauls and pasenger travel on roads, on the average, are over short distances as compared with the railways, and a large percentage of both of these originate and terminate within one province. There remain the other two bodies; the provincial and the municipal. The first means one central organiation, the second means a large number of small organizations. In order to discuss which type of control would be better let us examine what is required of the road.

Types of Traffic

As the purpose of the road is service, we must know to what type of traffic we are to render service and what it requires. It is evident that the road must be constructed to suit the traffic (within reasonable limits), instead of expecting the traffic to suit the road.

The first two divisions to be made are; (1) serving a well-developed district and, (2) serving a new district. The traffic in the developed district will be outside of through traffic, and local traffic. The through or outside traffic will consist of strangers to the road and those more or less familiar with the road and will consist nearly all of motor traffic. The local traffic will consist largely of team-drawn loads with some (and rapidly increasing), motor truck loads, automobile traffic, (mostly of the district), and some light steam traffic. The traffic to be served under the heading of "new districts" will be mostly local traffic consisting chiefly of team-drawn loads, and a very light motor traffic.

What service is required by the stranger to the road? If he is a stranger to our country he may be on a tour intending to cover a considerable distance, and will be interested in passing through the country from one city to another along main highways. The impressions which he retains of our country will depend on the enjoyment which he obtains from his trip. He probably will have a schedule laid out which he wishes to follow. To serve him the road must first of all be safe under all conditions.

Abstract of a paper presented at the General Professional Meeting of the Engineering Institute of Canada, Winnipeg, Man., September 7, 1922.

It must be well marked so that he may follow it at any time with certainty and ease of mind. It must be passable at any time during the travelling season. It must be a fairly direct route from city to city and must connect up with similar roads in adjoining provinces. Road laws must be the same throughout. A similar service is required by the man who is more or less familiar with the road. To this man, safety, directness and passable conditions of the road are most essential as he will undoubtedly be driving more at night than will the stranger; and in many cases a saving in time due to directness of route means actual dollars to him. In addition to the service required by the stranger he will require more highways, reaching more cities and towns. The roads to serve these two classes must be designed primarily for automobile traffic.

What service is required of the road for local traffic? The traffic will consist of team-drawn loads from farm to market, and from town to town; some truck loads mostly from town to town with a chance that there will develop a motor truck traffic from farm to market. There will be auto traffic from farm to town and from town to town partly for pleasure, partly for business. There will be light team traffic, school vans on some roads, and some roads will be mail routes. For team-drawn loads the road surface should be passable in any sort of weather. It should be so that the cost of transporting the load is a minimum. It should be safe under all conditions; and should be direct. For truck loads it is even more important that the roads be passable at all times. Grades are not so important as for teams but directness of route is more important. Local auto traffic demands a road safe at all times, but perhaps, is not so much concerned if the road should not be first class for a few days at a time. School vans demand that the roads be in good condition at all times during the school term and especially is a safe road required for this class of traffic. The postal routes must be safe and passable at all times.

Three Classes of Roads Required

Summing up for this division of traffic it appears: First, there are three classes of traffic and consequently three classes of roads; (1) "through" traffic requiring "through" roads; (2) town to town traffic; and (3) farm to market traffic. This latter including school van routes and probably postal routes. Summing up the service which each class of traffic requires we see that all require safety; mostly all require that the road be passable at all times; next directness of route; next light grades; and then a well marked route. To all these classes there should be added the pleasure seeker or the man who is out for recreation only and who desires to see the beauty spots of the country. He is interested only in roads which are safe and passable at all times and which run through the prettiest portions of the country.

The requirements in a district being opened are quite different from the older settled district. Auto traffic will be comparatively lighter and team-drawn vehicles will constitute the greater portion of traffic. The total volume of traffic will be light and speed not such an essential item. The road ditches in many cases must serve for draining the country. The service required by a road in this country is such as to justify a much cheaper type of road than in the older districts, but nevertheless it is a very important service which they must render.

Executive Requirements

Having considered the service requirements of the different types of traffic let us see what is required of the executive to provide this service,—evidently a competent organization and money. To give the service required by those using the road the organization must consist of men who have knowledge of how to produce the results required, and the man who pays requires that the organization consist of men who can produce the results economically. To quote partly from the Commission of Highways for Canada, the organization must consist of "— — men who have had the training and experience to meet the problems which arise — " and who "— — have been imbued with the public service idea and the necessity in the public interest of expecting one hundred cents in the dollar in value of workmanship and materials — —." This organization is expected to be capable of gathering engineering and economic data, correlating it, applying it, and filing it; of looking after the carrying out of construction; and as fully important, if not more so, of looking after maintenance; of seeing and knowing that work is properly done, money properly expended and that accounts and records are properly kept. To do this, the organization must have men of several types of training.

Some of the data to be gathered consists of facts about the amount and type of traffic which now uses the road; facts which will govern the change in volume and type of traffic which will use the road, when it has been improved, and in the future; facts regarding the cost of construction and maintenace of different types of road, the amount and kind of service which they will render under different traffic conditions; engineering data which will enable him to design the proper type of road and bridges to render the service required; facts regarding the costs of construction and maintenance; facts regarding the different methods of carrying out work and the use of different machinery and materials. The gathering of this data requires a man with a certain sort of training. The keeping of accounts requires another type of training. Men are required with office training for detail office work. The organization of the staff and keeping it running requires a certain type of training, as well as the man who has the general direction of the carrying out of the policy and relating it to the public. Evidently then, men of several different types of training are required for an efficient organization. To give the service which was stated as required by different types of traffic we know that safety requires a smooth, even surface, a proper cross-section, strong culverts and bridges, protection of high fills, and clear view, and for through roads, uniformity. To be passable at all times means generally some type of surfacing and the proper type of surfacing for the traffic. Both of these require immediate, constant and uniform maintenance.

The Need of Control

With control in one large central body an organization can be constructed of the men with the different types of training required to give the proper service. Continuous safe roads will be constructed, marked and maintained in a uniform manner. Proper machinery can be purchased in larger quantities and at opportune times. Gravel pits and stone quarries can be purchased for present and future use. Work can be planned and arrangements made for carrying it for some time ahead and in proper order. Authority and uniform laws can be authorized by legislation easier to one body than a great variety of laws to a large number of bodies. Arrangements for financing the work can be easier and better made. The cost of the work can be properly placed when it has once been decided how the costs shall be borne. On the other hand the provincial organization offers a greater chance for manipulation by politicians. There is an opportunity in a large organization for a large waste of funds and for over organization. The members of the organization may not take as keen an interest in the work as might members of municipal organizations. Provincial government organizations are generally bound by fair wage schedules in having any work carried out.

Where Control Should Be Placed

Municipal organizations are free of control by provincial politicians. They are more intimately connected with the work and there is less chance of a squandering of funds. There is a probability of a keen interest being taken in the work on account of their intimacy therewith. They are not bound by fair wage schedules but free to obtain labor on an open market at competitive prices. They have intimate knowledge of the local prices. They have intimate knowledge of the local requirements for roads. They can generally get work done cheaper by local labor in small portions than can the larger organizations. On the other hand, they cannot build up an organization of men with the different types of training required. Continuous and uniform roads will not be constructed; each municipality will construct roads according to its idea, often with no regard to continuity and sometimes each councillor will construct his own peculiar type of road in his own ward. One municipality will have safe roads and the next very poor roads. Proper machinery for construction and maintenance cannot always be purchased. Large gravel pits for future use will not likely be reserved. Materials cannot be purchased at such an advantage. Roads will not be as uniformly marked. Raising of money will be more difficult and alloting of costs cannot be so fairly done. Records will not be so well kept.

These are some of the things to be considered in deciding how the roads are to be controlled. There are also several forms of dual control which might be considered. The province to have control of some roads and the municipalities of others. The control might be under the municipality subject to certain control and approval by the province, or vice versa and all shades and varieties of these dual controls. It would be only under ideal conditions that dual control would work out satisfactorily. After the decision as to who shall have control comes the selection of the organization. Considerable space might be devoted to consideration of this. Once the organization is properly formed, a big step towards the success of the road policy has been taken. After this comes the method of construction. The selection of engineering detail and once the right organization with sufficient authority has been formed, these can be satisfactorily worked out.

The Financial Problem

Coming to the financial question, this might be divided into three heads; (first) How much money should be spent yearly on roads; (second) how it is to be raised; and (third) on what basis will the cost be distributed The answer to the first question is beyond the knowledge of the writer, but it appears that by a proper study of wealth produced in this country, and from a study of value which might be received from good roads, that the maximum and minimum amount which should be spent on roads could be arrived at. This appears to me to be an immense question in itself, involving not only a study of present value which would be received, but also of future benefits which might accrue. This last includes a study of our material resources, probably methods of development as related to roads, and a study and plan of the whole future development of our country. This opens to us a vision of what the road question means when considered in its wide aspects.

The second question has been answered in many ways in different provinces and countries. The money must be raised from either, (1) current revenue; (2) term debentures; (3) capital account; (4) a combination of any two or more of these methods. The selection of which method should be used is a study in itself and should be decided by men of training in financial matters who are familiar with the various factors that determine which method should be adopted. The method that would be satisfactory in one section of the country might not be satisfactory in another. If members of a community had the opportunity to loan money in small sums at a higher rate of interest than they could borrow in large sums, it might be better to borrow money for roads. This might be the case in one community and not in another. If money can be borrowed at a time when one bushel of wheat will get one dollar and paid back when one-half bushel of wheat will pay off a dollar, it might be of advantage to borrow. In a new district it might pay to borrow money to improve the roads and open up

(Concluded on Page 108)

Sheet Fabric Reinforcement for Concrete Pavements

A Discussion of the Proper Weight and Construction Methods to Be Employed to Secure Satisfactory Results

By W. C. KUHN
American Steel and Wire Co.

THIS is a subject far reaching in its possibilities and on which there has been considerable thought and investigation, by engineers and others interested in highway construction. We all must admit at the start, that there is still a lot to be learned about the construction of highways, and judging from the various specifications for steel reinforcement for cement concrete pavements, we are far from the ideal to which we are all striving. Each year's work, however, is adding to our fund of knowledge, and it is quite possible the time is not far distant, when we will have standard specifications for reinforced cement concrete pavements.

The Importance of Proper Weight

As my subject has two subdivisions I will take up first the subject of the proper weight of steel fabric reinforcement. On this question, at the present time, there is a wide variation as to specifications, running from 25 lb. per 100 sq. ft. to 90 lb. per 100 sq. ft. In New York state alone, there were five different weights, i. e.—25, 30, 40, 56 and 60 lb. per 100 sq. ft., the weight called for depending on the conditions to be met on each project. New York this year adopted 63 lb. as standard.

Pennsylvania state specifications for the past two years have called for 56 lb. per 100 sq. ft., an increase over their previous specifications which called for 25 lb. This state is now considering the advisability of increasing the 56 lb. specification, and at this writing have about decided on 65 lbs. as standard. Throughout New England the specifications have varied from 25 lb. to 40 lb., one contract in Bennington, Vt., calling for two lines of reinforcement 28 and 40 lbs. respectively, making a total of 68 lbs. In the South 25 lbs. per 100 sq. ft. was the usual specification for the few reinforced concrete highways that were built to the past year. However, on work advertised during the fall of 1920 and subsequently, the engineers in Virginia, West Virginia and North Carolina have been specifying for heavier reinforcement, but South Carolina still calls for 25 lb. In the middle West the specifications vary from 30 lb. to 55 lb., Kansas specifying 45 lb., Kentucky 40 lb., Minnesota 55 lb., Ohio 30 lb. and Arkansas 40 lb.

In New Jersey 34, 45 and 56 lb. have been specified for single line reinforcement, and on double line reinforcement 34 and 56 lb., making a total of 90 lbs. The 34 lb. specifications have been chiefly for country work, and there are many reinforced concrete roads in New Jersey with 34 lb. of steel that are standing up perfectly. A number of these are located near Freehold.

The 45 lb. specification was for the two sections of the Fort Lee Turnpike, across the North Jersey meadows. This heavier fabric was specified to offset the hazards of the soft ground over which the road was constructed. The result seems to have justified the extra steel as one section 3500 ft. long has been down since 1917 and the second section, 1000 ft. long since 1919, and there are only one or two cracks in the entire road. There is a tendency, however, to increase the New Jersey County specifications to 56 lb. to correspond to the state specifications for single line reinforcement. Judging from the results that have been obtained by the use of 34 lb. material, I do not see the logic of increasing the cost of the road to this extent, especially in view of the fact that practically all county roads are in the secondary system and not subject to the heavy traffic of the main or through routes. On main lines where the thickness of the slab has been increased to 8½ or 10 in. or more, I consider the 56 lb. specifications more justified.

The manufacturer of steel has no objections, from a sales standpoint, to the increase in weight, as this means more tonnage; but there is certainly a limit beyond which it would not be justifiable to go, based on adequate strength and economy.

The Necessity of Reinforcement

The primary reason for reinforcing cement concrete pavements is to take care of contraction and expansion due to temperature changes. Steel having practically the same co-efficient of expansion as concrete, it permits the entire mass to contract or expand uniformly. Steel also adds tensile strength to the concrete. This is a decided advantage during such times as the concrete is contracting. The friction between the slab and the sub-grade is apt to be sufficient to cause the unreinforced slab to crack due to the low tensile strength of the concrete. With the reinforcement in the slab this cracking is prevented.

Steel reinforcement also adds strength to the slab and helps to distribute the stress caused by any deficiency in the sustaining power of the subgrade. It also binds the concrete together and prevents cracking when the slab is forced upward by the action of frost. If by any chance the concrete should crack, the steel reinforcement holds the slab together and prevents the cracks spreading, thereby preventing any appreciable amount of moisture reaching the subgrade. This is borne out by the experience of the city of Sheboygan, Wis. This city put down their first reinforced concrete pavement in August 1911. It was a two course pavement reinforced with triangle mesh style No. 7 having No. 12 gage longitudinal and No. 14 gage cross wires all 4 in. center to center and

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Abstract of a paper presented at a convention of the New Jersey Highway Association.

weighing 21 lb. per 100 sq. ft. C. N. Boley, city engineer, advises that while small cracks formed, these were not maintained in any way until the year 1919. In November 1921 the pavement was torn up to put in sewers and upon inspecting the pieces of concrete removed it was found that the wires showed no signs of deterioration and measured full gage. This is another instance proving that steel properly imbedded in concrete does not rust and functions perfectly regardless of the length of time the concrete has been in place.

As our highway traffic is increasing daily and the weights of loaded trucks seem to be almost unlimited, it has been necessary to endeavor to provide roads that will be capable of meeting future requirements in so far as we are able to foresee them. For this reason the thickness of the concrete slab has been increased from 6 and 7 in. to as much as 10 and 12 in. at the crown with a corresponding increase at the sides. Naturally this would require a greater amount of steel to reinforce the greater volume of concrete. Therefore, considering the manner in which the thinner slabs have stood up reinforced with 25 to 35 lb. per 100 sq. ft. or say 56 lb. as in New Jersey's 1921 specifications, is ample reinforcement for satisfactory results.

It is not practicable to design and construct our concrete highways as a clear span from edge to edge of the slab. This would make the cost of construction so expensive that it would be prohibitive. It is, therefore, necessary to properly prepare the subgrade by draining and rolling, so that there is reasonable assurance of the slab being supported at all points. We, therefore, get back to the original intention of reinforcing for contraction and expansion, and any steel added over and above this can be considered as an extra expense.

Proper Construction Methods

This brings us to the second part of my subject, the proper methods to use to secure the desired results with sheet fabric reinforcement. Under this heading can be included the type of fabric and its location in the slab. Sheet fabric would include any type of woven wire reinforcement, or expanded metal.

All members both longitudinal and transverse should be uniformly spaced and securly fastened together at each intersection. This insures having the required area and weight uniform throughout the slab and provides for full benefit from the reinforcement and maximum life for the road. The area of steel per foot in each direction should be specified, as well as the minimum and maximum spacing for all members composing the fabric.

As it is a fact that cold drawn wire has a higher tensile sideration and an increase in weight and area should strength than rolled bars, this should be taken into con- be required when bars are substituted. Otherwise, a certain amount of strength would be lost which is most undesirable.

My suggestion for the specifications would be as follows:

The reinforcement used shall be a fabric of cold drawn steel wire, the members of which shall develop an ultimate tensile strength of not less than 70,000 lb. per sq. in. and shall be capable of bending cold 180 deg. around one diameter without fracture. The fabric shall be free from excessive rust, scale or coating of any character which will impair the bond with the concrete.

The main wires of the fabric shall be spaced not less than 4 in. or more than 6 in. apart and shall have a sectional area of not less than 0.140 sq. in. of steel per foot of fabric. The transverse wires of the fabric shall be spaced not more than 12 in. apart and shall have a sectional area of not less than 0.025 sq in. of steel per foot of fabric. The above type of fabric will weigh 56 lb. per 100 sq. ft.

The fabric should be placed in the road 2 in. from the top of the finished slab. This allows the reinforcement to act in tension when it is most needed, which is at the time the slab is settling after a thaw. My contention is that when the subgrade freezes the heaving action will be fairly uniform across the slab. When the thaw occurs, it is the outer edges of the slab that are apt to be first affected, allowing a more rapid settlement at these points than at the center of the road. This would tend to cause a canti-lever effect throwing the top of the slab in tension, and the steel being located near the top would add strength to the concrete and prevent cracking.

Special Reinforcements Necessary

Over sections of the country where the subgrade is poor, I believe two lines of reinforcement are advisable, and the heavier fabric should be not less than 2 in. from the bottom of the slab. With two lines of steel the slab is reinforced for both the heaving action of frost, and the bending action of loading.

Experience has shown that the cracks that cause the most trouble are those running approximately parallel with and along the center line of the road; therefore, the greater portion of the reinforcement should be placed across the pavement. I consider this holds for the road constructed with the center longitudinal crack as well as the single slab construction.

The desired results in road construction are maximum service with minimum cost of maintenance. I, therefore, believe that all concrete slabs should be reinforced which would include the concrete base for roads finished with a bituminous concrete or asphalt top. The reinforcement will add strength to the base and if cracks should occur it will hold the slab together and prevent the top from being forced into the crack by traffic and thereby cause an uneven surface.

The addition of reinforcement would permit or reducing the thickness of the concrete base by at least an inch and effect a saving in the cost of the road. At present day prices the saving as compared with one inch of concrete would amount to 15 to 25 cents a square yd. depending on the weight of the steel 56 lb. per 100 sq. ft. or lighter.

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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ROAD MATERIAL RATE REDUCTION UPHELD

Some months ago the Public Utilities Commission of Ohio ordered railways in that state to make a 28 per cent. reduction in freight rates on materials used in road building. The railways protested and carried the case to the Ohio Supreme Court. That tribunal has now upheld the order issued by the Public Utilities Commission and it is understood that the railways will appeal either to the U. S. Supreme Court or the Inter state Commerce Commission. The decision of the Ohio court, however, means that present freight rates on road building materials will probably continue during the present building season and that there will not be during that period, any substantial increase.

Thus continues, in one phase or another, the conflict between rail and road, with transportation rivalry at the bottom, though not always openly admitted. With motor freighting companies using trackage built and maintained by the public, while the railroads must provide and maintain their own roadbed, there is reasonable ground for railway complaint. The balancing of the two transportation forces to a point where each will serve as an aid to the other will in due time become an accomplished fact, but not until highway surfaces are brought up to the same standard of improvement as the vehicles now in use.

Taxing vehicle operation to overcome incessant repairs on weak roads, is false economy. With adequate road investment, there will be no complaint on the part of vehicle interests to paying their just share in highway construction and upkeep.

UNLOAD THE SAME DAY!

In this period of car shortage, now that the I. C. C. has granted relief to construction, when the railroads are cooperating and when Government officials and other agencies are sympathetic to the needs of construction, it is imperative that contractors must help! Their part is to unload cars the same day they receive them, even if this necessitates extra expense and working into the night. Let your railroad officials, and agents know you have unloaded, so that the cars may be moved without delay. It certainly behooves contractors to cooperate in this manner, because the railroads will give preference to those contractors who do.

T. J. Wasser, Chief Engineer of the New Jersey Highway Department and President of the American Road Builder's Association, is strongly urging contractors to cooperate in this way. In backing up the work of the A. G. C. and in his executive capacities, Mr. Wasser, with S. M. Irwin, of the Union Paving Co., of Philadelphia, and representative for New Jersey on the Special A. G. C. Highway Committee, met with members of the Interstate Commerce Commission, September 15, to discusss the whole situation. Unload the same day!

A NOTEWORTHY EVENT IN MARYLAND

With the approval of Governor Ritchie, the State Roads Commission of Maryland has formally designated a new million dollar road leading from Baltimore into the Southern part of that State in honor of Robert Crain, whose stock farm in St. Marys County is one of the show places on the Potomac River. Mr. Crain was the first man to propose the building of the road, and worked so incessantly upon legislative and financial phases of the project that it has been deemed a just tribute to name the highway in his honor.

In recognition of the value of the Southern Maryland road project to their trade, the people are preparing to erect a monument at the head of the highway in Upper Marlboro. Construction will start on September 30. On that date a celebration will be held at Upper Marlboro at which State and Federal officials will speak. Among the officials who have accepted invitations to address the assemblage are Governor Ritchie, Mayor W. F. Broening of Baltimore, John N. Mackall, Chairman of the State Road Commission, Robert Crain in whose honor the highway is named, and two United States Senators.

This event—local in character to Maryland—has also a National significance. The opening of a new highway is today an occasion which ranks in importance with the launching of a new railway in decades past. The days of the Golden Spike are no more.

BID PRICES FOR JULY

Accepted bid prices on Federal aid roads averaged for the whole United State for the month of July have just been issued by the U. S. Bureau of Public Roads. The prices are as follows:

Common excavation 35 cents per cubic yard, unclassified excavation 63 cents per cubic yard and rock excavation $1.29 per cubic yard.

The following prices per cubic yard are for surfacing material in place on the road: Grave $1.65, and clay $1.42 and crushed stone $2.72.

Surfacing per square yard in place on the road cost as follows: Gravel 50 cents, bituminous macadam $1.63, bituminous concrete $2.40, plan cement concrete $2.09, brick $3.40.

Reinforcing bars 4½ cents per pound and structural steel 8 cents per pound, both in place.

There is considerable variation in the cost of the various items in the different States due to various rreasons. The complete table listing the items by States may be obtained upon request from the Bureau of Public Roads.

COLORADO ROADS SCENES TO BE FILMED

Colorado's highways including the most luring scienc stretches and prairie routes are soon to be filmed for inclusion in the See-Colorado-First motion pictures series through which it is hoped to boost Colorado as the mecca state and playground of the nation.

In addition, typical camping ground scenes in virtually every important town in Colorado, including the free camp ground at Overland park near Denver, will be included in the films series.

Hundreds of feet of film portraying the scenic beauties up Bear Creek canon and in the envirions of Evergreen, Eldorado Springs, and Idaho Springs have been taken already. Arrangements are being made to begin photographing the beauty spots in Boulder county and in the neighborhood of Fort Collins, Colorado Springs, Pueblo and Canon City soon.

The Lookout Mountain drive is to be included in the series it was declared, as well as the Silverton-Ouray stretch, parts of the principal trans-continental highways and the like. It is expected that many of these outstanding points of scenic interest will be filmed by the See Colorado First company before the close of fall.

NEW ROADS IN INDIANA

Twenty-two miles of hard surface pavement of 28-miles contracted in three projects on the National road between Indianapolis and the Ohio state line, and 18-miles of 35-miles contracted on he same road between Indianapolis and Terre Haute, are completed, according to announcement today by John D. Williams, director of the state highway commission. Most of the new pavement will be opened to traffic in a short time, Mr. Williams said Parts of it are now used by local traffic.

There remains to be built this season six miles between Indianapolis and the Ohio line, and approximately 170 miles on the west end of the road. The Indiapolis-Terre Haute projects are divided into five contracts. Anticipating that weather conditions will permit the laying of concrete as late as November 15, it is reasonably certain all pavement contracted on this road east of Indianapolis will be completed this year, highway officials believe.

Inspection and aid by the state highway department in changing the proportion of materials without making the cost more on a county road project, resulted in a decidedly better highway, according to a letter received by the highway commission from the Roann Chamber of Commerce.

Some time ago Wabash county contracted for three-quarters of a mile of bituminous concrete road to run through the main street of Roann. State inspection was obtained and an analysis of the asphaltic mixtures caused state engineers to change the proportions of the course aggregate to give a better grade and concrete base.

This change resulted in a splendid road entirely to the satisfaction of the people of that vicinity, says Samuel Baird, secretary of the Roann Chamber of Commerce, who writes John D. Williams, highway director, in part as follows:

"Assuming you will be pleased to receive word and sentiments of our people regarding the Conner road, and on which the state highway department gave efficient inspection and help otherwise; as secretary of our Chamber of Commerce, I am pleased to inform you that the road is now completed, and it is the general belief of our people that the pavement is second to none, any place or any kind."

Under Indiana laws county projects may secure state inspection if fifty or more taxpayers of the county wherein the improvement is to be made, petition same.

PLAYTIME ON AMERICAN HIGHWAYS

With the gradual development of State Highway systems, and the welding of these systems into a national network through logical connection at state boundary lines, the open road is fast becoming America's playground. The pleasures of highway travel, once open only to those who are possessed of sufficient wealth to own an automobile, is now available to practically every citizen in the United States. Over a million highway users went camping last summer. That mark will be exceeded by almost another million during 1922, so great has been the increase in motor vehicles purchased during the first half of the present year. More than three hundred cities now have municipal motor camp sites, and many more are planning to establish similar accommodations. In 1921 there were 598,000 campers using municipal sites, whereas hundreds of thousands more camped in State and National reservations. These figures indicate the extent to which pleasure travel has shifted to American highways. The also sound a warning against anything less than substantial construction.

The State of Wisconsin leads all other states in the matter of marking her highways. It is said to be almost impossible for the motorist to become confused or lost on her highways. The Colorado Highway Department is considering the advisability of adopting the Wisconsin marker system.

On the theory that an ounce of prevention is worth a pound of cure, the District of Columbia has selected a given road territory on which patrolmen have been placed and whose duty it is to locate highway defects and report the same immediately. Just as soon as reported, the damage is repaired. While the patrolmen in the District of Columbia are not specifically called upon to furnish information to drivers, yet this service naturally follows in the performance of their duties.

CONCAVE CONCRETE PAVEMENT

A leading feature of a system of concrete road construction proposed by Mr. S. H. Walker, of the Walker-Weston Co., 7 Wormwood street, E. C. 2, London, England, is to make the under surface of the concrete slab, and also the surface of the road, slope down from the sides of the center, instead of cambering it in the usual way whereby the center is higher than the sides. He argues that if the slope is downwards from the sides to the center the concrete when it expands sideways under the influence of heat or moisture will have to do so uphill against the action of gravity, and when it contracts it will so to speak, pull itself together towards the center of the road. For a country arterial road having a roadway 30 ft. wide or more he would make the formation slope downwards 1 in 16 from the sides to a central level portion 6 feet wide.

The formation would consist of a porous layer of ashes or clean gravel well rolled with a 10-ton roller and left with a perfectly smooth surface upon which the concrete slab would be able to slide freely, special care being taken to see that the bearing capacity is equal throughout. The concrete slab would be perhaps 12 in. thick at the middle, but thinner at the sides. The concrete at the bottom would be composed of 1 part of cement to 6 parts of Thames ballast, or like mixture, and the surface layer, 2 in. thick, would consist of 1 part of cement to 1¼ of sand and three of 2½-in. broken granite chips, and would be laid just before the bottom concrete had set. The slab would be reinforced by a double layer reinforcement weighing 12 lb. per square yard, and consisting of top and bottom layers of steel connected together to form a mattress by diagonal tension shear members. The surface would slope uniformly down to the center at 1 in 30 to 1 in 50. Such a slope, while ample for a clean surfaced road like concrete, would hardly be noticeable; but as the part of the road nearest the footpath would be the driest and the slope and character of the surface would be uniform, the slower horse traffic would naturally tend to keep close to the curb, thus remedying one of the causes of traffic congestion.—Times Engineering Supplement, London.

INUNDATED SAND INVESTIGATION

The Bureau of Standards has started an investigation to determine the feasibility of measuring sand for concrete in an inundated condition.

Preliminary investigations have indicated that if the vessel in which the sand is measured contains sufficient water to submerge the sand, the same quantity of sand can be placed in the vessel regardless of the quantity of moisture originally obtained.

The investigation is to determine whether the measurement of sand inundated will effect uniformity in the proportioning of sand to cement and consequently uniformity in the strength of the concrete. An affirmative answer to this question would mean the solution of one of the most troublesome problems in the concrete industry.

BRITISH ROAD EXPENDITURES

The subjoined figures, prepared by the Ministry of Transport, give estimated expenditure on road improvement and maintenance by highway authorities in Great Britain during the year ended March 31 last; the estimated expenditure by the same authorities for the same purposes during the current year; the estimated proportion of that expenditure in respect of which grants from the Road Fund have been or will be made; and the total estimated grants from the Road Fund in respect of Class I and Class II roads, respectively, for each of the two years:

Estimated expenditures by highway authorities during—	
1921-22	£45,000,000
1922-23	40,000,000
Frants from road funds during—	
1921-22	26 per cent
1922-23	28 per cent
Road fund grants to Class I and II.—Roads and bridges—	
During 1921-22—	
Class I, £6,347,000; Class II, £1,027,000	£7,374,000
During 1922-23—	
Class I, £6,600,000; Class II, £1,900,000	8,500,000

As these figures are to some extent estimates, they must be regarded as approximate only.—"The Surveyor," London.

ARLINGTON ROAD TESTS SHOW PROGRESS

The road research investigations of the U. S. Bureau of Public Roads at the Arlington experimental station are now well under way. A new portable road-impact machine has been received and is giving most satisfactory results in testing the series of road slabs placed earlier in the season. This series consists of 120 concrete slabs ranging from 4 to 10 in. in thickness and from lean to rich mixtures. Some of the slabs are reinforced and others have a 2-in. Topeka top. There are at least two slabs of each type of construction, one on a dry subgrade and another surrounded by ditches, which are kept flooded.

Briefly the new machine consists of a typical truck wheel with spring and variable load above it, which is raised and allowed to fall on the slab from any desired height by means of an electrically driven cam. Recording devices measure the deceleration or rate at which the wheel is brought to rest after coming in contact with the slab, the deflection of the slab at a number of points on a line across the slab, settlement of the slab into the subgrade, permanent set of the slab and the maximum instantaneous fibre stress at the point where the blow is struck.

On the first slab tested the various recording devices checked each other with surprising closeness. For a series of blows varying slightly in intensity curves for the fibre stress, deceleration, and deflection showed corresponding variations and gave assurance as to the accuracy of the new methods of measuring. Some interesting information as to the variation of the support offered the slab by the subgrade under a series of varying blows is being secured.

With the information and experience gained from last year's experiments on impact making possible refinements in the new tests it is thought that an analysis of the data when all of the slabs are tested to destruction will throw a great deal of new light on truck impact on rigid pavements.

The circular track for the testing of asphaltic concrete to determine the cause of waving is also now about ready for the automatically controlled truck traffic. Twenty-seven sections of asphaltic concrete of various mixtures have been laid on a cement concrete base, the course aggregate of the bituminous mixes ranging from 40 to 70 per cent. with variations in the grading of the finer material. The amount of asphalt varies from 5.5 to 7.0 per cent. and has a penetration value of from 45 to 85.

In line with the bureau's policy of cheapening the cost of road construction by the use of local material wherever possible a circular track for a wear test on concrete has also been completed. Sixty-one sections of concrete have been placed. The aggregates used vary in kind and quality, ranging from hard to soft and there is variation in the amount of mixing water and time of mixing. In order to eliminate the effect of differences in the subgrade the sections are of reinforced T-beam construction, the slab being 4 ft. wide, 10 in. deep with the T-beam in the middle of the slab. The traffic test on these sections will begin soon and the load on the pavement will be made to represent the rubber tired rear wheel of a 3½ or 5-ton truck moving at a speed of 15 to 20 m. p. h. Specimens of concrete for beam strength and compression tests have been made from each mix and are being cured under the same conditions as the corresponding sections.

Results of this wear test, representing modern traffic conditions, together with the beam strength and compression tests which will be made for this investigation and on a similar set made in connection with the impact investigation and which will serve to tie the two together, will furnish a sound basis for the consideration of suggested changes in specifications for concrete road aggregates.

Equipment — Trade — Materials

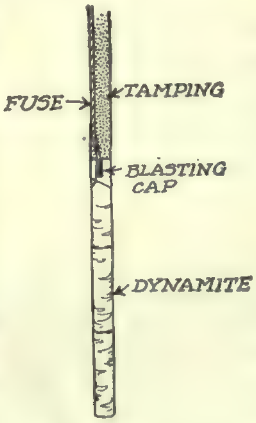
HEAVY ROAD GRADING WITH A GAS SHOVEL

Contractors are beginning to realize more and more the efficiency of the gas shovel even in the heaviest digging. J. J. and M. S. Mergens, contractors at Minneapolis, Minn., are among the many users who believe in gas rigs and they back their convictions upon performance of their equipment under the most difficult circumstances. They have a contract for 6¾ miles of state highway in Dakota County, Minn., and their equipment consists of a Pawling & Harnischfeger ¾-yard gas shovel, a Western elevating grader and a 60 h. p. Best tractor.

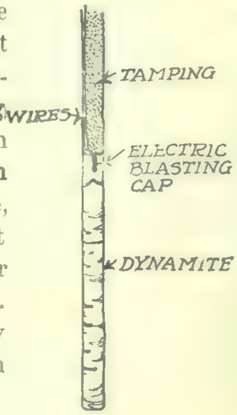
The excavation in their contract amounts to 110,000 cu. yds., practically all of which is within two miles. This portion of the road has to be cut through a succession of hills and valleys, so that the road consists of alternate cuts and fills. Some of the cuts are as deep as 18 ft. A great deal of the material being excavated is a ledge rock which comes in layers and breaks into pieces weighing between 5 and 100 lb., it being estimated there are about 20,000 cu. yd. of this class of excavation.

The heaviest of the grading has been done by the P. & H. gas shovel which has attracted quite a number of contractors in the vicinity by its excellent performance in this heavy excavation. The lighter excavation is being taken care of by the Western elevating grader drawn by the tractor.

PROPER USE OF DYNAMITE



In large blasting operations, it is extremely important that special attention be given to the prepation of the detonator for the explosive charges, as a misfire in such operations is a serious and dangerous matter. Although the subject of loading dynamite cartridges has been given attention for years, du Pont engineers of the E. I. du Pont de Nemours have found that some explosive users continue to use incorrect methods, thus not only creating what may develop into dangerous conditions, but actually losing money by the failure to get the most efficient results from the use of dynamite.



The right way to prepare the charges, according to the du Pont Company, is shown by the accompanying illustrations. Employing the first method, with the cap in the **top** cartridge, pointing **down** toward the bulk of the charge, with lots of tamping and no part of the fuse touching the powder will give a perfect shot every time. Or, if the firing is done electrically as shown by the second illustration a perfect shot will also result.

SHEET FABRIC REINFORCEMENT FOR CONCRETE PAVEMENT

(Continued from Page 101)

the country for settlement and the increase in wealth produced might repay several times over the money required to pay back the debt. No attempt will be made here to solve this question, but merely point out that the road question is not one of simply pushing up earth with a push grader, but is one requiring the services of men of a variety of training and experience.

The third question, "On what basis will the cost be distributed," offers another field for considerable study in order to arrive at an equitable solution. In most public utilities those using the utility bear the cost; but others besides those using the roads receive benefits. The land owner who has a good road constructed by his land is receiving benefits from the road even if he lives miles away, his farm not under cultivation, and the road never used by him. It seems reasonable that he should share some of the cost of the improvement, and that the whole cost should not be carried by those using the road. If a good road tends to reduce the cost of marketing produce or enables the gardener to get his produce to the consumer in a fresher state surely the consumer is securing some benefits. If a good road enables children to get to school where otherwise they could not, who can place the benefits which may be received from the result of the education of a child which may become the leader in our country.

Distribution of Costs

As the money must be provided by the individual, in the final analysis we must give consideration as to how the cost is to be distributed to the individuals. This might be done on the basis of ability to pay, or on the basis of benefits received. While taxation on the basis of ability to pay might be a fair basis for certain government services, it does not appear to be equitable that this should be the only basis on which to secure revenue for road construction. In general, public utilities rendering similar service are paid for on the basis of service received and this appears a fair basis for obtaining a greater portion of the revenues for road construction. Its equitable application is difficult if not impossible. Those receiving most of the direct services are the users of automobiles, motor trucks, farm teams, other team loads, light teams, school vans and mail routes. The majority of automobiles and motor trucks do most of their traveling on certain main highways and town to town roads, but they do some travelling on other roads; farm teams do most of their hauling on market roads, but they do some on main highways and town to town roads; the landowner, we saw, received some value; the consumer of products receives some value; and the people at large receives some value. The question is in what proportion do they receive value from good roads. We assumed that the average motorist travelled 5,000 miles per year at a cost of 10 cents per mile. If the good road reduced the cost only ten per cent. it would be worth $50 per year to him but this is away low in the saving which will be effected. In the first place you cannot run a car on poor roads for less than 15 cents per mile; secondly, the saving will be much in excess of ten per cent in the cost of running the car, and thirdly, a saving of still greater value will be made in the saving of the time of the passengers. If automobiles were taxed $50 per year and this money put into proper roads they would, on the average, still be money in pocket. With half this money we would have a yearly road fund of over 11 million dollars from this source alone. We estimated that 56 millions tons of freight were hauled over rural roads at a cost of 5 cents per ton-mile. If the cost were reduced to even 30 cents per ton-mile we would effect a saving of over 6 million dollars yearly. The average value of farm land in Canada is estimated at $48 per acre. Suppose good roads were established and the value of land increased by $5 per acre, the interest on this at 6 per cent is 30 cents per year or about 6 mills per acre. Suppose we ask only one-half this value to put into roads or 3 mills. The estimated value of farms and farm buildings in Canada is over 4 billion dollars. A rate of 3 mills would give another 12 million dollars yearly. If we asked each poll to contribute 10 or 15 cents per year for general value received we would add another million to our revenue, making a total yearly revenue of about 30 million dollars. We pay the railways directly over 369 million dollars per year. The point to be brought out is that there are several classes of beneficiaries from good roads that consideration must be given to arrive at an equitable distribution of costs, mostly on the basis of benefits received and that when these costs are distributed on this basis each person will be paying only a portion towards the value which he will receive.

The Three Essential Factors

It has been possible in this paper to point out only some facts which must be considered in deciding on a road policy. The main things which should be brought out are:

(1) That Service is the first consideration in a road policy.

(2) That the road problem is a large one and worthy of consideration by able men.

(3) That men of a variety of training, of broad experience and sound judgment should be requested to give their assistance in solving the problem of what should be a proper policy for a country.

Tennessee has spent $883,000,000 on road repairs and maintenance in the last few months. Alabama has expended about $5,000,000 in highway improvements the past summer; Georgia has increased its funds for repairs and extensions of the state systems to $780,000; Kentucky has contracts estimated at around $900,000; Louisiana, $932,000; Mississippi, $844,000; North Carolina, $7,780,000, and South Carolina, $1,104,000.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

Vol. LXIII September 27, 1922 No. 13

TABLE OF CONTENTS

How Shall We Finance Our Highways? 109
By R. M. Hubbard

The Inspection of Concrete Construction 110
By J. K. Dickerson

The Development of a National Transportation System 111
By Frank Terrace

The Determination of Road Resistances 112

EDITORIAL AND NEWS:

Nation's Business Turning to Highway Transp'n. 113

"Safety First" on the Highway 113

Rules and Regulations Issued for Federal Aid Road Work 113

Kentucky to have 14,000 Miles of Hard Roads 114

Vermilion Parish Votes $2,500,000 for Roads . 114

Highway Construction Outlook in Wisconsin . 114

EQUIPMENT—TRADE—MATERIAL:

Link-Belt Crawler Crane 115

Miami Fordson Trailer 115

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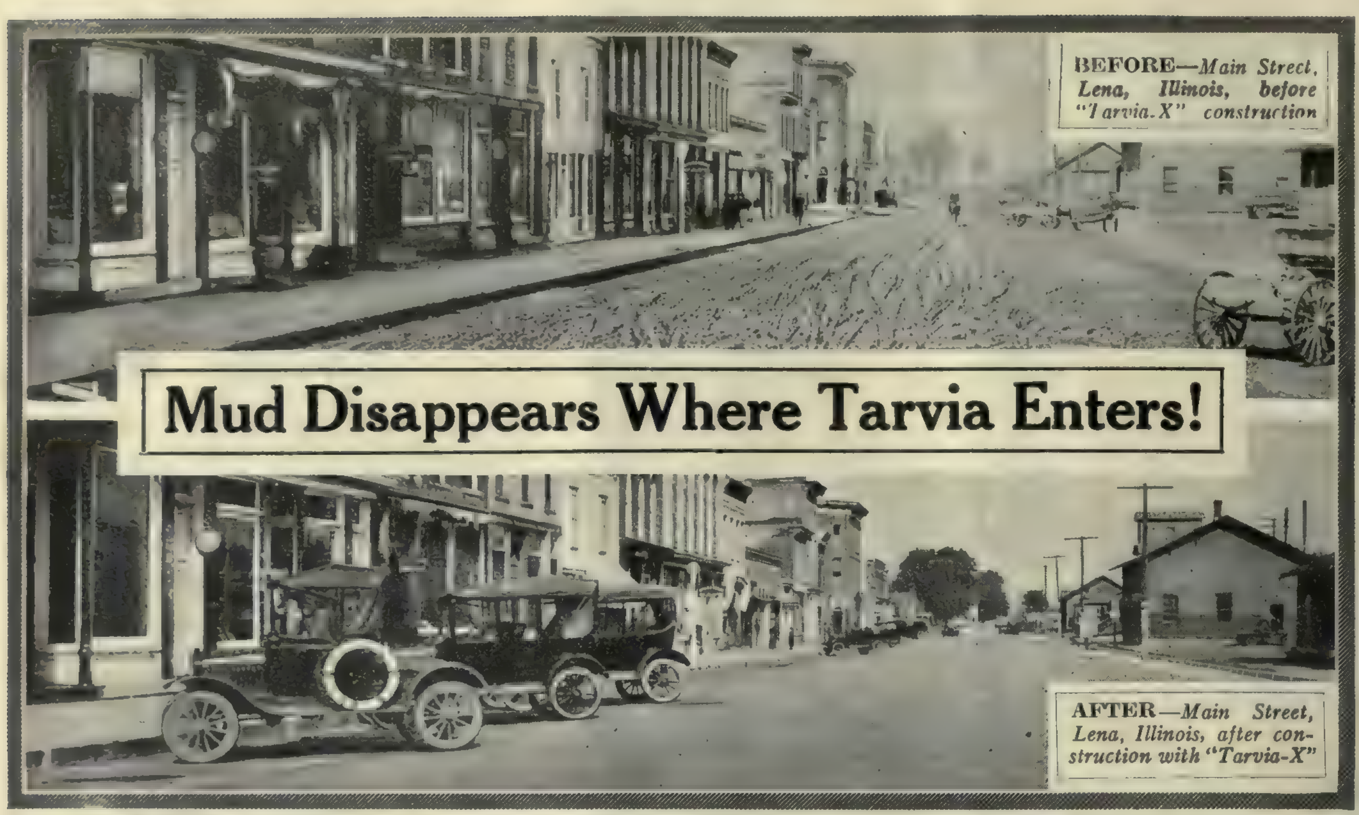

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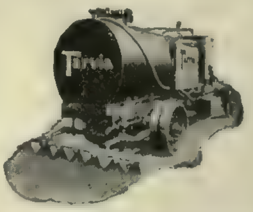

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Vol. LXIII SEPTEMBER 27, 1922 No. 13

How Shall We Finance Our Highways?

A Discussion of the Fundamental Problems Involved

By R. M. HUBBARD

Chdirman of Texas State Highway Commission

THE steadily increasing demand for more and better highways arising from the increase in motorized traffic during the past few years, has resulted in a financial problem so great as to make it imperative that our method of highway financing must be changed and developed, if the necessary road support is to be secured and if serious consequences to the motor vehicle industry, to the taxpayers and the community as a whole are to be avoided. Many students of this problem are beginning to appreciate the importance of the situation, and are devoting their time and energy toward securing a correct analysis of the problem and a sane program of finance.

Two Fundamental Questions

There appear to be two fundamental questions involved. The first relates to the division of the cost of constructing a system of highways as between the present tax payer and future generations. To what extent shall the roads be paid for by taxes and to what extent by bonds. The second question relates to the division of the cost as between the user of the road and tax payers in general. A correct answer to these questions would solve the problems.

It is not the purpose of those charged with the duty of completing a connected system of state highways, to raise the necessary funds for this purpose regardless of the source, but they desire to equitably place the burden on the shoulders of those who receive the benefits of the roads, in direct proportion to such profits. It will require a combination of engineering knowledge and sound economic analysis coupled with honest conscientious study to arrive at an accurate and just solution of this problem.

Certainly the present tax payers want good roads. They want and deserve as many good roads as are economically justifiable. It is obvious that fewer good roads can be built, if the present generation undertakes to pay the entire cost of all roads built, than if a portion of the costs were met by the proceeds of bonds. The question is just how much of the cost should be charged to the future generation, and bonded in a sound defensible program for roads.

We instinctively dislike large public debts—and rightly so. Few of them leave tangible assets. The public must be shown that there is a permanent asset in good roads—well constructed and properly located. Until this is done, public temper will not permit large bond issues for road building purposes. That there is a permanent asset in a well constructed and properly located road is fast becoming an admitted fact. This being true then it is right and just for the future generation to bear part of the cost of construction, for it is axiomatic that each generation passes on to the next must be adequately covered by sound assets passed on to that generation. Therefore, the question dwindles down to "What part is considered a permanent asset?"

Road Maintenance

After the road has been completed and our bond money spent, what do we expect?? Not a road that will stay intact and resist the heavy motor traffic and bad weather year in and year out, without being properly maintained. In fact, we expect the surfacing to wear and wash, but we must not overlook the actual increase in value of the permanent investment as the years go by. In other words, the subgrade is better as it becomes compact, the bridges are improved, the hills are cut, the safety factors are strengthened and railroad crossings eliminated. Use of the road deteriorates the surface, but only enhances the other factors.

Maintenance of the road after construction is requiring a great deal of study on the part of those charged with the duty of constructing and maintaining the highways in the state and nation. It has been suggested, and the writer endorses the suggestion, that the definition of the word maintenance be extended so as to include not only the day to day and year to year expense of keeping the highway in serviceable condition, but also to include resurfacing whenever needed. In this way, the road would never wear out, but would be turned over to the next generation unimpaired. A road once built to a given standard would be maintained for all time to that standard, each generation assuming the responsibility for maintaining it during the time it used the road. This would make the life of the road indefinitely long, and such a definition, if adhered to, would destroy the argument against long term bonds. It would seem just that the users of the roads should pay the cost of maintenance including resurfacing and new drainage structures.

In this manner we would be able to raise the necessary sums to build an extensive system of highways without unloading on the present generation of general tax payers the heavy charge of amortizing highway securities in a 15 to 20 year period. Long term bonds would compel the succeeding generation to pay its part of the cost of the road passed on to them. The success of this theory would require the writing into the law of stringent requirements as to maintenance and a classification of resurfacing as a maintenance charge.

It has been urged that the users of the road should pay the whole cost. This would be utterly unfair. We must remember that roads were necessary before motor vehicles were known. Of course the road must be built to a higher standard in order to accommodate motor traffic, and I believe this increased cost would be properly chargeable to the motor vehicle owners. Not only does the motor vehicle owner derive benefits from the good road, but every property owner derives benefit from it. His property is increased in value, but his schools are better, and prosperity reigns when good roads are built. I recently saw the idea summed up this way:

Poor roads: poor schools,
Ignorance, poverty;
Good roads: good schools,
Knowledge, prosperity.

Statistics prove that bad roads are one of the fundamental causes of illiteracy—school attendance increasing in exact proportion to road improvement.

Of course the motor vehicle owner should pay for the maintenance of the road and also pay the additional amount needed to build the highways up to the standard required by motor traffic. The highways cost more than they otherwise would because of the necessity of supplying accommodation to a particular group of users and such additional cost may be properly chargeable to this particular group.

As a suggestion and as a means of stimulating a discussion which will lead to a more rational system of highway finance—one which will build roads as quickly as economically desirable—one which will not unfairly repress nor yet subsidize the automobile industry, and one which will distribute the tax burden fairly, it is recommended that one-half of the amount necessary to meet federal aid or one-fourth of the cost of construction be met by an ad valorem tax or by the proceeds from long term state bonds, and the other half necessary to meet federal aid be met by license fees. Then levy a tax on gasoline sufficient to maintain the roads, including resurfacing and replacing drainage structures. The general tax payer would, in this way, be paying one-fourth of the amount necessary for construction. The motor vehicle owner would be paying one-fourth the estimated amount necessary to build the road up to motor traffic standard, the federal government would pay the other one-half for construction and the user of the roads would pay the cost of maintenance.

I would have it understood that I am not urging, nor do I favor a big bond issue, but if necessary to issue bonds at all, make the issue small, or just sufficient to pay for one-fourth of the total cost of construction. Then not sell them all at once, but sell them as they are needed to construct the permanent features of the road.

The Inspection of Concrete Construction

By J. K. DICKERSON

THERE are several important facts to be carefully considered in order to secure good results in concrete construction: First: The crushed stone or gravel used as coarse aggregate must be selected carefully as to its quality. The cements to be used should be of one of the well-known tested brands of Portland cement, of which there are a number on the market, and should be carefully and frequently tested.

The sand to be used should be of such quality as prescribed in the state highway specifications. The stone or gravel should be properly graded according to size, and be of such quality and quantity as is prescribed in the state highway specifications.

After the selection and grading of the aggregates as to the mix to be used, it then becomes the duties of the superintendent in charge of the work, and also the inspector in charge, to see that the aggregates are thoroughly mixed before placing in the forms, and to have the same properly placed and tamped so as to exclude all air and water pockets, and proper care must be taken in the curing of all concrete placed.

Following this a field test should be made from time to time to note if any change had taken place, as often the shipping and handling of material will change the condition of the mixture, and care should be taken in the placing of reinforcing steels as such steel is figured to resist compression thrust and shear as natural elements. Sample blocks of concrete should be secured from each day's pouring, and a test sample made of each car of cement and all such samples dated and preserved for reference. All concrete should be of that mix that would be the most dense, a 1-2-4 mix really is a 1 to 6 mix, as

(*Concluded on Page* 116)

Developing a National Transportation System

Both Railroads and Highways are Essential to Permanent Prosperity

By FRANK TERRACE

THE people of the State of Washington are confronted with two tremendous problems at the present time, First, the supervision of our wonderful highway system, and Second, the preservation of the steam and electric railways. The legitimate function of a highway is first, the accommodation of private owners of vehicles for their individual pleasure and business. They are not designed or intended as permanent roadbeds for transportation business, and can never be depended upon to fulfill that function.

Only a comparatively few years ago we began the consideration of a system of highways designed to be mechanically the best and most complete in the country, but the advent of the motor bus and truck has demonstrated that with all the increased cost of each succeeding section of roadway built, we have not yet developed a roadbed which will stand the everlasting pounding of this traffic for which highways were never intended. Roads that were designed and built honestly for 95 per cent. of the traffic have been hammered to pieces by 5 per cent. of the traffic, which latter refers to the busses and trucks, and, to what end? The early destruction of many of our highways, calling for rebuilding on a far more expensive scale, and calling for all new highways to be designed for the heaviest traffic, which is only 5 per cent., if that 5 per cent. is to be allowed to continue, and all this an added burden for the taxpayers.

Free Rights of Way Unnecessary

Are we to continue this expensive construction and maintenance to provide a practically free right of way roadbed and maintain the same for a traffic which pays nothing for its use except a simple license, the same as any ordinary vehicle? It is generally conceded that a highway capable of standing the legitimate 95 per cent. of travel can be built for $30,000 per mile (16-ft. road). If this abnormal traffic is to be perpetuated, we must pay at least $50,000 per mile, an extra $20,000 per mile for 5 per cent. of the travel. Are the taxpayers going to stand for this—to make and maintain such roads for a traffic never contemplated, which cannot take the place of railroads, and only serves to bankrupt them?

Electric and steam railroads are absolutely the only safe, sane, and permanent means of commercial traffic, and no country can prosper without them. Their rights of way must be bought, tunnels and cuts made, bridges and culverts built, tracks laid, engines and cars bought, all kinds of buildings erected at enormous cost to operate this essential means of transportation must be paid for, and interest and profit earned, while the same railroads must pay their share of cost and maintenance of the highways which are giving practically free rights to their competitors. Can we do without railroads? If not, we should see that they have the right to a fair return on their investment.

The burden, because of our heavy taxes in this state, is becoming well nigh unbearable. Undoubtedly there is extravagance in many places. Undoubtedly many people should be taken off the pay roll. Some officials seem not to know that the war has ended. They are keeping war crews and paying war wages. It is high time to stop this.

There is inefficiency in many places and there are many people on the pay roll who do not earn their keep. There are lots of fellows who wouldn't hold their jobs five minutes if they were put on the farm or anywhere else where one must put in full time to get his pay. There is underefficiency.

The Plight of the Farmer

The farmers of this state have suffered because the public authorities, state and county, in employing people, especially on the road building, set a day rate with short hours, that would bankrupt every farmer in the whole state if he had to meet it and he is more or less in competition with it. When a man in the hay field or milking cows receives his three dollars a day working 10 hours and finds that right along the road a fellow is working at four or five dollars a day, eight hours, the farm employee becomes dissatisfied and then trouble arises. All the farmers are up against this competition, and it is not playing right with the producers. This would not exist if the employing official had to pay the bill.

We must discipline these fellows that make this trouble, or we have got to quit the business of farming. The taxes on farms are running all the way from $2.50 to $20.00 per acre, and that is prohibitive. The farms are the bulwark of the state—of our entire nation, in fact. If we do not take care of this basic industry which furnishes 80 per cent. of all the production, we cannot boast of being the "Great United States."

Another need is that we must amend the law so that the public carriers on our highways shall, in addition to the license that they pay, like all private owners, pay a given percentage out of their gross income to be used to repair the extra and unusual damages which they cause. These big, heavy carriers, with their tons and tons of weight, will in one trip over a given road, do more damage to it than a hundred of the ordinary passenger cars. They will not submit, probably, to pay this honest requirement, and when we start to talk and act they will then put up their powerful pleas and claim

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Abstract of a paper presented at the 23rd Annual Convention of the Washington State Good Roads Association, September 16th, 1922.

they are not making any money. As a rule, such concerns talk real poverty. They sometimes shed tears. I have found that when we get after one of the big concerns, that is making a lot of money, that the greater the poverty plea it puts up, the more money it is making. They all do it. You will hear from them when the bill comes in before the legislature next winter. But their bark will not hurt, for they will not bite.

Be on the lookout for their cry when the time comes to act, but don't let them scare us off and lose again. None of us wants to pay any more taxes than we have to, for the payment of taxes is not always a pleasure, but a duty. But, these public carriers are not doing their duty for they are receiving a privilege for which they do not pay adequately. We, therefore, must work with and sustain our legislators, when they are elected, to the end that this principle shall be enacted into law, and the highway upkeep cost placed where it ought to be.

The easiest way and cheapest plan of obtaining money for road building and upkeep is by a tax on gasoline. We must not lessen our interest nor lay off in any way in pushing our road program to completion, but we may change, if thereby we get a better way. If we should amend the law by abolishing some of the milage rates that we have now on the books, and in lieu thereof, collect two or three cents a gallon on gasoline, we would be far better off because we would abolish a large amount of machinery in the state, and all we would need would be to have one or two men going about checking up the three or four gasoline companies bringing the product in the state. It is very easy to get these facts and we would receive a large amount of money which is now collected at heavier expense. We would abolish bureaus in Olympia, and much extra machinery in the counties. You are strongly urged to consider with favor this proposed plan. But, don't levy this gasoline tax as an additional burden.

A New License System Needed

Our car licensing system is cumbersome and expensive and could be improved. After the state has prepared the license plates, they should then be sent out in proper numbers to the different counties, and when a man goes in for his license, he should pay his license money, together with the amount for the drivers' tickets which he wants and the plate and license cards should be then delivered to him by the County Auditor. It will take no more time of the County Auditor than now where he takes the money and issues a temporary license, delivering a card, and then sends the money to the State Treasurer who must finish the job. This is duplicating official machinery. By adopting the new plan suggested, all the Secretary of State will have to do with the Auditor is to send the license plates and blank cards out, and in turn he will receive the money from time to time. I would think there are thirty or forty people in the license department at Olympia that could be dispensed with if this were done, without adding any in the county office. It would be in the interests of economy and cause quicker dispatch.

I am only touching upon these questions now, because they will be discussed at length upon the floor, and by persons who have given close study to the questions. The program has been made with that in view. That is, to have large and free discussion from the floor.

I would recommend that all our main highways entering into the great centers of population be increased to 100 feet wide. I would also recommend that there should be sidewalks provided for foot passengers, as it has become very dangerous. Children going to school and other foot passengers have to use the ditches, or even get over the fences into fields, and there is no more safety or security for them on our public highways.

The Determination of Road Resistances

IN determining the amount of tractive force or ''pull' required of animal or automotive traction, to move a load over any road, there are three kinds of resistances to be considered, namely, rolling resistance, grade resistance, and axle resistance.

Rolling resistance varies depending upon:

1. the diameter of the driving wheel
2. the number of revolutions per minute or hour of the driving wheel
3. the effectiveness of springs
4. the nature of the tires
5. the method of attaching tires to rims
6. the width of the tire in inches, and load per square inch
7. the degree of uniform hardness of the surface.

The most important of these factors in rolling resistance are Nos. 1 and 2, which determine the speed of the vehicle, and No. 7, which usually conditions No. 6. The width of the tire becomes of lesser importance as surfaces become harder.

Grade resistance varies also, depending upon:

1. the elevation of the road, expressed as a percent-of the inclination or rise, from datum; and,
2. the weight of the load in pounds.

Like rolling resistance, grade resistance is a force expressed as so many pounds. The latter is determined by multiplying the weight of the load expressed in pounds by the amount of grade expressed in hundredths.

Axle resistance is due to the condition of the bearing surface, value of the lubrication, etc. For a wagon it amounts to two or four pounds per ton. But in the case of automotive traction, the resistance is negligible.

Tractive resistance is then the sum of the rolling resistance, and the grade resistance. Various experiments have been made by different authorities with a view to determining the amount of ''pull'' necessary over level stretches of different types of roads, different standards of condition of the same types, and over different grades. The results of these experiments have often varied widely. The explanation is, in part, that the same governing conditions have not obtained, in the different experiments. Factors in rolling resistance, such as Nos.

(*Concluded on Page* 116)

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NATION'S BUSINESS TURNING TO HIGHWAY TRANSPORTATION

That the business of the nation is turning more and more to highway transportation is indicated by statistics on motor-vehicle registration as of July 1, compiled by the Bureau of Public Roads of the United States Department of Agriculture. Registration of passenger cars, taxis, busses, and motor trucks totaled 10,620,471 on this date, an increase of 157,176, which is a healthy growth, as the first half of the year is the off season for registration of new vehicles.

The surprising fact, however, is that, of the 157,174 increase in registration; motor trucks constituted 116,701, against 35,030 passenger cars and 5,443 taxis and busses. This means an increase of over 16 per cent of the number of motor trucks at the beginning of the year. Figures are not available to show what part of the increase of 5,443, or nearly 11 per cent, in the taxi and bus registration is due to the increase in the number of busses traversing rural and suburban routes, but it is very probable that a considerable part of the increase is due to the development of this new form of transportation.

It has been frequently said that the traffic is always ready and waiting when good roads are built, and that the commercial vehicle as a class is more handicapped by lack of good roads than the pleasure vehicle. The increase in the registration of commercial vehicles, coupled with the present activity in highway construction, seems to bear out this statement in the opinion of department officials.

"SAFETY FIRST" ON THE HIGHWAY

Officials of the American Automobile Association are asking their members throughout the country to sign the "Pledge of Carefulness" issued by the Highway Education Board of Washington in connection with its safety program for 1922. The pledge follows:

"Realizing my responsibility as an American citizen to secure the safety of others by careful conduct on the streets and highways, and,

"Realizing that the accident and the death toll of my nation, state and city can best be reduced by thoughtfulness and carefulness.

"I pledge myself to be considerate of the rights of others while on the streets and highways; to learn and observe traffic rules and regulations to the best of my ability; to co-operate in a campaign of carefulness, either as a pedestrian or as a driver of a vehicle, and I will, by precept and example, endeavor to assist others in making streets and highways safe."

The Highway Education Board conducts each year a safety program which includes the "Safety Season," from September 10 to December 16, a national safety essay contest among elementary school pupils, the national safety lesson contest among elementary school teachers and the observance of "Seven days for safety," which this year will be from October 8 to October 14 inclusive, and the A. A. A. is co-operating in all these plans

The endeavor of the association through distribution of safety posters and literature, talks in the schools, motion pictures in the various theaters and other means of propaganda is to reduce the toll from traffic accidents. With the ever increasing number of automobiles using the highway safety precepts are becoming an increasingly important part of every school curriculum and automobile owners all over the United States are taking a constantly greater interest in measures designed to make the highways more safe.

RULES AND REGULATIONS ISSUED FOR FEDERAL-AID ROAD WORK

Rules and regulations for administering the federal highway act of Nov. 9, 1921, have recently been promulgated by the Secretary of Agriculture. The chief points in the new regulations are as follows:

On request the state highways departments, before any agreement is reached regarding road construction, shall furnish information regarding state legislation, organization and equipment of the highway department, funds available and provision for maintenance. Each state is required to file with the secretary a statement showing the proposed federal highway system, and indicating the primary and secondary routes, constituting, respectively, three-sevenths and four-sevenths of the so-called 7-per cent system. The secretary will thereupon inform the state highway departments of the acceptability of the system and when agreement is reached on the whole or a part of the system the state shall make a formal request for approval.

Pending formal approval, only such projects will be approved as are on routes indicated on the proposed system. After the system shall have been selected, designated and approved, no project statement shall be submitted for any route or part of any route not embraced in the system. Until plans, specifications and estimates of cost for the project shall have been found satisfactory, no project shall be placed under contract.

Grade crossings shall be classified for priority between the state departments and the United States Bureau of Public Roads. No part of the expense of surveys, plans, specifications or estimates prior to the beginning of construction work shall be included in the estimate or paid by the federal government.

No federal money shall be paid "until it has been shown to the satisfaction of the secretary that adequate methods, either advertising or other devices appropriate for the purchase, were employed, prior to the beginning of construction, to insure economy and efficiency in the expenditure of such money." If the contract be awarded to any other than the lowest responsible bidder, the federal government shall not pay more than its pro rata share of the lowest responsible bid, unless it be shown that it was advantageous to the work to accept the higher bid.

No part of the money appropriated under the act shall be used directly or indirectly to pay or to reimburse a state, county, or local subdivision for the payment of any premium or royalty on any patented or proprietary material, specification, process or type of construction, unless purchased or obtained on open actual competitive bidding at the same or a less cost than unpatented articles or methods, if any, equally suitable for the same purpose.

KENTUCKY TO HAVE 14,000 MILES OF HARD ROADS

By the spring of 1923 Kentucky will have 1,400 miles of hard surfaced road under State maintenance, according to Joseph S. Boggs, chairman of the State Highway Commission. At the present time there are 780 miles of such road in the state and more than 300 miles now under construction that will be completed by fall. Several hundred miles will be improved during the winter and early spring brought up to State requirements by April of next year.

The state road department also intends to build as rapidly as possible the main trunk lines, establishing lines of travel across the state along the most strategic routes, and to supplement the trunk line system with the primary road system authorized by the Legislature. This primary system is limited to about 4,000 miles under the present law. Roads feeding into the trunk lines and the roads designated as part of the primary system must be built and maintained by the counties.

Chairman Boggs named six trunk line roads, which he considers the key to the road building operations in Kentucky. With these six roads completed and hard surfaced there will be a natural demand for feeders leading into them from counties they traverse and from adjacent counties, he thinks.

The roads mentioned are the Midland Trail, Eastern Division of the Dixie Highway, Jackson Highway, the Bee Line Dixie, the Ohio River Road, from Louisville to Paducah, and the East-West, or Jefferson Davis Highway, from Wickliffe through a belt of central counties to a junction with the Jackson Highway at Bear Wallow, Barren county.

VERMILION PARISH VOTES $2,500,000 FOR ROADS

Vermilion Parish has taken its place among the progressive parishes of Louisiana in the remarkable road building programme of that extremely rich state. It would not be far from the mark to say that no state in the Union has so extensive a schedule of road building. Millions will be spent this year and for several years to come, and in a very short time the ambitious project of connecting every county seat in the state with model hard surfaced highways will be an accomplished fact.

Vermilion Parish has just voted a $500,000.00 tax and bond issue to link up its capital, Abbeville, with the neighboring parish seats of Iberia, Lafayette and Acadia, besides providing for a considerable mileage for lateral roads in the road district. The popularity of the movement is evidenced by the fact that although the road district is composed of five different wards in the parish, and that election day was one of the most inclement of the year, there were 736 votes cast, giving a majority of 500 in number of votes, and over $2,500,000 in value of assessment, in favor of the tax. This splendid result was largely the work of the Chamber of Commerce of Vermilion Parish.

A reference to any map of Louisiana will show the importance of the new routes which will be opened to the travellers east and west through this favored portion of the Evangeline country. It will afford a new and shorter route between New Iberia on the east and Lake Charles on the west, opening up a new county line to the tourist.

HIGHWAY CONSTRUCTION OUTLOOK IN WISCONSIN

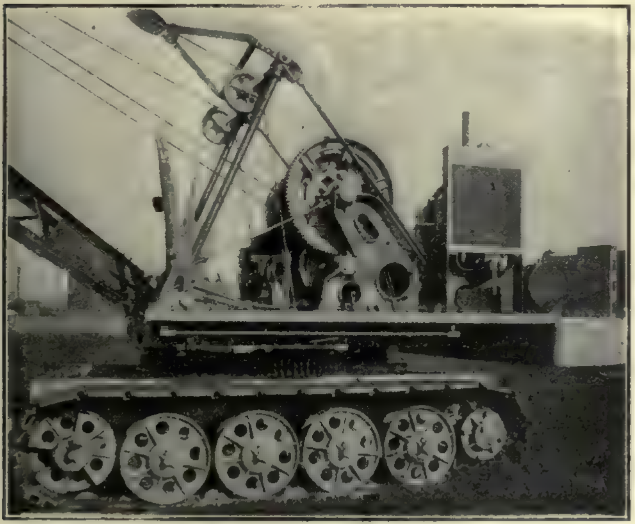
Highway construction in Wisconsin has been hard hit by the coal and railroad strikes, according to the state highway department, which estimates that of the more than 400 miles of concrete construction which has been projected only about 300 will be completed this year. There are several reasons for this.

Despite the curtailment in Wisconsin's highway construction program caused by the coal and rail strikes, this state will not be as badly hampered as many other states. This is due to the plentiful supply of gravel, especially in southeastern Wisconsin, where most of our concrete paving is being done. A large percentage of this type of work in this state does not require the ra shipment of aggregate. Of the 1922 program about 60 per cent will be supplied from local pits and quarries and does not require the use of railway equipment except for cement. In this respect, at least, Wisconsin is fortunate even though the entire 1922 program as planned will not be consummated.

Equipment — Trade — Materials

LINK-BELT CRAWLER CRANE

The Link-Belt new Crawler Crane shown below weighs complete without bucket approximately 22 tons. It will safely lift 10 tons at 12-ft. radius, and 3 tons at 30-ft. radius. The hoisting speed is 125 ft. per min. with a maximum rope pull of 10,000 lb. on a single line. Having two independent band-clutch-operated hoisting drums, the machine is thus suitable both for clam-shell and dragline bucket work. The crane will rotate four complete revolutions per minute, travel ¾ mile per hour, and climb a 20 per cent grade.



Link-Belt Crawler Crane

The lower frame of the crane is a single annealed open hearth steel casting, designed with ample factor of safety to carry all the various severe diagonal stresses a machine of this character is undergoing, and for which the ordinary structural steel frame very poorly provides. This construction insures absolute rigidity of the frame under all circumstances, doing away with all unnecessary friction caused from pinched shafts.

The hoist and hold drums are 16 in. diam., 12 in. face, each with 32 in. diam., 3 in. face expanding band clutch of the same construction as the reversing friction clutches described above. The brake drums are mounted on extended hubs of their respective rope drums, connected to them by means of ratchet-and-pawl mechanism, which enables the operator to set his brakes either before or while hoisting his load, so that the moment he pulls his hoist clutch out of engagement his load is instantly automatically held in position. This enables a less skilled operator to operate this crane successfully, as it requires a certain amount of dexterity to manipulate clutch and brakes simultaneously. It also increases very materially the speed with which grab bucket work can be done.

The boom is 35 feet long and is made of angle and lattice bar construction, parabolic shape. The main hoisting sheaves are 18 in. in diam. for ⅝ in. diam. 6-9 Plow steel hoisting cable. Four parts of same size cable is used for the boom hoist. A swing band brake is provided on the vertical rotating shaft for holding the boom in position during travel.

Special attention has been given to the operator's cab and machinery housing. The house is made of substantial steel construction throughout, with ample windows and door for light and ventilation. Inside the housing there is an unobstructed platform 30 in. wide, the full length on each side of the rotating base, which makes it very handy to get at all the machinery. The housing is so constructed that the machinery can be readily dismantled without disturbing the housing.

MIAMI FORDSON TRAILER

The Miami Fordson Trailer illustrated has been designed to meet the exacting conditions of reduced transportation costs for all classes and kinds of materials adaptable to the hopper design of body of the rear or bottom dump type. It has a cubical content of 2 yd. rounded load with provision for mounting a ½ or ¼ yd. flared top-box for increased cubical capacity to transport materials of a total load of 2½ tons of greater bulk than 54 cu. ft. The rear-bottom type of dump door is so designed and controlled that the entire load may be dumped in one spot or the load spread to any desired depth by the control of the width of opening of the release or dumping door. The entire load dumps and spreads to the rear of the axle of the trailer. The winding and release levers are operated from the tractor trailer unit for either dumping or winding. It can be backed into any position.

Miami Fordson Trailer

The dump body may be removed, the drawbar lengthened, and a platform type of body substituted when usages so demand.

THE INSPECTION OF CONCRETE CONSTRUCTION

(*Concluded from Page* 110)

the voids in the aggregate may not conform to the 1-2-4, and the mixing and placing quality depends on the ability of the inspector, who should know how to grade the mix to secure the most dense concretes. A lean mix properly handled is superior to a rich mix carelessly mixed and placed.

All concrete structures should have an inspector of known ability, as well as reliability, though I do advise the placing of graduates on all large structures as assistant inspectors to take charge of the mixing and see that the aggregates are properly apportioned and mixed before leaving the mixer. As in some cases the mixing plant is some distance from the structure and a very slight change in the mix will cause a future rupture. From the present outlook it will be advisable to educate some of our worthy young men in the practical work of concrete construction.

I find there is in some locations too little attention given to channels under structures. All channels, where possible, should be excavated so as to divert the water and flow from abutment and wing wall footings, and said channels should be of sufficient width and depth to take care of both intake and outlet under all normal conditions. The exercise of good judgment in this matter may save very large future expenditures to the State and counties interested.

THE DETERMINATION OF ROAD RESISTANCES

(*Concluded from Page* 112)

1 to 7 inclusive, above have not been identical. Again, the classification of the types of roads used in experiments bears upon the results obtained. A good road in one section may not be so regarded in another section.

The results of a series of experiments with average conditions conducted by a reliable authority to determine resistances to automotive traction, using a light commercial vehicle, over different types of "improved" roads, and the resultant consumption of gasoline, at average rates of speed, are as follows:

Type of level road	Pounds pull per ton load	Miles per hour	Miles per Canadian gallon
Improved earth................	82 to 218	4.6	6.93
Improved gravel..............	78 to 81	9.5	6.82
Water-bound macadam........	64	....	11.38

It will be observed that the excess of mileage made per gallon of gasolene is considerable for each type of improved road, over that made over the lower type. Twice the distance was made for the same amount of gasolene used, in travelling over the paved surface than in travelling over the improved earth road. In other words the saving of gasolene as between these two types of roads is approximately 50 per cent. Similar experiments have placed the saving in gasolene consumption, depending upon the various factors in resistance, entering into the experiments, at 20 to 60 per cent.

Having no regard to the "bad-road" taxes, motorists are called upon to pay in the form of repair expenses, nor to other necessary expenses in the operation of motors, the extent to which every operator of an automobile is interested in road conditions may be illustrated by a few simple calculations. Assuming that the average operator travels in a season 5,000 miles, if he makes, say, 10, 15, or 20 miles per gallon of gasolene, his purchase during the season, at 40 cents per gallon, will amount to a sum ranging from $200 to $100. Hence, it is clear that were all the roads over which he operates his cars uniformly good, his annual saving would amount to, at least, $50 for this item alone.

The ruling grade sought by road-builders in level country is about 2.50 per cent, that is to say, an average rise and fall of one foot in forty feet; in hilly country, it is about 5 per cent; and in mountainous country it is about 7 per cent. However, providing roads are hard-surfaced, grades as high as 10 per cent can be easily surmounted by any of the least powerful motor vehicles.

Determination of the grades, upon different types of road surfaces, upon which operation of motor vehicles ceases to be economical, is a matter that as yet has not received the attention of highway and automotive engineers, and of the public interested in the progress of transportation facilities, that is desirable. For while the economical operation of all carriers depends upon the conditions of the highway avenues of travel, in a country with as much undulating territory as Canada, the determination of a ruling grade that is satisfactory to operators of long distance automotive equipment is necessary data precedent to the commencement of a national programme of highway improvement.

The following table gives the amount of tractive force required in comparison with a level grade force, for grades up to 10 per cent, together with the equivalent lengths of roads, as on a level road, first-class condition, in tractive force, to pull a ton:

Per cent of grade	Rate of inclination	Tractive force in pounds per ton	Equivalent length
0.00	level	38	1.00
0.20	1 in 500	42	1.10
1.00	1 in 100	58	1.52
1.25	1 in 80	63	1.66
1.33	1 in 60	71	1.87
5.00	1 in 20	138	3.63
2.50	1 in 40	88	2.30
3.33	1 in 30	104	2.73
4.00	1 in 25	118	3.10
5.00	1 in 20	138	3.63
6.67	1 in 15	171	4.50
10.00	1 in 10	238	6.26

Comparing the equivalent lengths in tractive forces, as on level grades, required on 5 per cent and 2.5 per cent. grades, namely, 3.63 and 2.30 times the level tractive force, it is seen that the former is 57.8 per cent greater than the latter. Hence, to this extent, the costs of operation of motor vehicles are greater over hill roads than over the common roads.

For fast and light traffice, it is desirable that grades do not exceed 2 per cent, which amounts to a rise of 105.6 feet in a mile. Grades from 2 per cent to 3 per cent are acceptable for ordinary traffic.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

Vol. LXIII October 4, 1922 No. 14

TABLE OF CONTENTS

Asphaltic Concrete Pavements 117
By R. G. Davidson

Drainage As An Aid to Better Roads 121
By Roy J. Randall

EDITORIALS AND NEWS:

"Safety Week" 122
Conference on Highway Construction 122
Kentucky to Investigate Qualifications of Bidders 122
Nevada Reaches Agreement on Northern Route 123
Forest Road Building Progresses 124
Colorado to Vote on Six Million Bond Issue . . 124
Bond Issue of $75,000,000 Being Urged in Tenn. 124
Dunes Highway Nearly Complete 124
Record Road Construction 124

PERSONAL MENTION 124

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII OCTOBER 4, 1922 No. 14

Asphaltic Concrete Pavements

A Discussion of their Advantages from both Construction and Maintenance Standpoints

By R. G. DAVIDSON

Northwest Manager, Warren Brothers Company

IN the consideration of asphaltic concrete, three important characteristics should have our attention, namely its water-proofing qualities, durability, and extent of use. As regards the first of these asphalt is the oldest water-proof adhesive known to man. Asphalt deposits in Southern California have yielded hundreds of complete skeletons of prehistoric animals in a perfect state of preservation after a period estimated at 200,000 years. This preeminently water-proofing quality is particularly important in pavements, the chief enemy of which is water. Alkali soils are very widely distributed throughout the Western states, and water frequently carries some alkali and other injurious matter in solution, and the pavement surface must resist its action. Bituminous pavements are not affected by the action of alkali; while, on the contrary, various rigid types are known to be disintegrated in a very few years by the chemical action set up in the road by alkali salts.

Durability of Asphaltic Concrete

Most of the heavily travelled roads in the world, including the thoroughfares of New York City, are paved with asphaltic pavements, many of which are over 20 years old and still serviceable. Based on the satisfactory experience with asphaltic pavements, all important cities use it to resist heavy traffic, and have excluded rigid pavements, it having been demonstrated beyond question that a pavement to be durable must have a bituminous surface to take the impact or blow of traffic.

Statistics show that over 55 per cent of all the higher grades are of asphaltic types, while less than 3 per cent are of the rigid, non-yielding types. Including both city and highways, the asphaltic types predominated over the rigid types for the year 1921, there being over 68,000,000 yards of new construction of asphaltic types during that year.

The recognized advantages of bituminous pavements, in general, are:

1. *Durability.* As proved by pavements and road surfaces in use upwards of twenty years and still in serviceable condition.

2. *Resiliency.* Ability to take the impact of traffic without cracking, which impact is known to do so much damage to rigid pavements. Tests have demonstrated that it takes upwards of fifty times as many blows to shatter a 6 in. bituminous pavement as it takes to shatter a rigid pavement of the same thickness. This resilient surface results in less repair to the automobile or autotruck itself, as the bituminous surface minimizes the shaking of the car or truck, due to the shock-absorbing character of the wearing surface, which augments the shock-absorbing appliances of the truck rather than working against it as do rigid surfaces.

3. *Greater Tire Mileage.* The cushioning effect of a bituminous pavement on the tire results in less friction between the tire and the pavement surface than exists with a tire travelling over a rigid pavement. A bituminous pavement can be brought to any degree of roughness by the rolling into the surface of Torpedo gravel or stone; but safety to the average careful driver does not make the rough surface desirable in the light of the economic loss through wear on the tires which would be caused by rough surfaces. Assuming each automobile spends annually $100 on tires, it can be shown that even a 10 per cent saving through greater mileage on tires travelling over bituminous paving than on rigid paving would mean a saving to the owners of cars in British Columbia, Washington, Oregon, and California of upwards of $10,000,000 annually on the 1,000,000 odd licenses issued in these states; and as affecting the entire country would mean over $100,000,000 per year saving. This amount is more than the entire road program of the United States extended through Federal Aid by the Bureau of Public Roads.

Presented at the Canadian Good Roads Association Convention, Vancouver, B. C., June, 1922.

4. *Construction Inconvenience and Detours Minimized.* In building bituminous roads, traffic can be maintained over the work during construction, and a great loss through inconvenience to the owners of cars and excessive detours and delays for long periods are avoided. (See Fig. 1.)

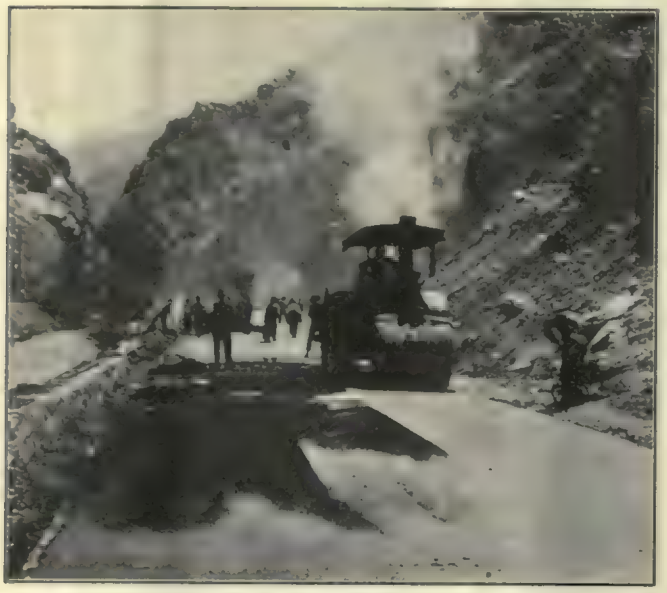

Fig. 1. A Warrenite-Bitulithic Road Under Construction

This view shows the rolling of two courses, resulting in their blending into one. A 1½ in. Warrenite-Bitulithic surface is being laid on 2½ in. bituminous concrete base road over old macadam, without detours or interruption of traffic.

5. *Ease of Maintenance and Upkeep.* Where subfoundations under the pavement give way, due to inadequate drainage or otherwise, the surface of bituminous paving can be built up and brought to proper contour by adding new bituminous material to the road in the places affected, and this without barricading the roads for several weeks and thereby delaying and detouring traffic. A bituminous road can be perpetuated by periodical applications of liquid asphalt and stone screenings, which adhere to the surface and extend the life of the pavement. If, in later years, traffic has increased to make reinforcements desirable, and the subfoundation has settled in places, weakening the pavement and causing the surface to present an uneven contour, the old surface can be given a coating of liquified asphalt and an additional thickness of bituminous material can be spread over the old pavement, and will effectively stick to the old pavement and will become one with it. The additional thickness acts as a reinforcement over the weakened places and reproduces the original satisfactory contour, thus utilizing to a maximum degree both the old and new material in the reinforced structure.

6. *No Glare to the Road Surface.* The dull gray of the bituminous road surface has no detrimental effect on the eye, as compared with the glare from pavement surfaces which are lighter in color.

7. *Home Products.* Utilizing local materials in the vicinity where the road is built is a point in favor of bituminous pavements. All materials used in bituminous pavements are on the open market, so that the widest competition is possible in its construction.

Asphaltic Concrete on Any Type of Base

The principal type of asphaltic pavement laid to-day is asphaltic concrete, being laid on any suitable base (See Figs. 2 and 3); but, generally speaking, one of the four following types of base is used:

1. Compressed crushed stone or macadam base.
2. Asphaltic concrete, commonly called "black" base.
3. Hydraulic concrete base.
4. Old macadam, concrete or brick pavements, as the case may be, utilized as a base to be resurfaced with asphaltic concrete.

Each of these bases has its place. However, the trend of the time is toward the increased use of macadam or asphaltic concrete base, as these bases assist the wearing surface in taking without injury the blow or impact of traffic. Recent tests made to determine the effect of impact on road surfaces have shown that an asphaltic concrete pavement on an asphaltic concrete base will withstand ten times as many blows from a 125-lb. iron ball falling through a height of 6 in. at the rate of 30 blows per minute as 2 in. of the same pavement will stand where same is laid on a rigid base (hydraulic concrete) of the same thickness. (See Fig. 4.)

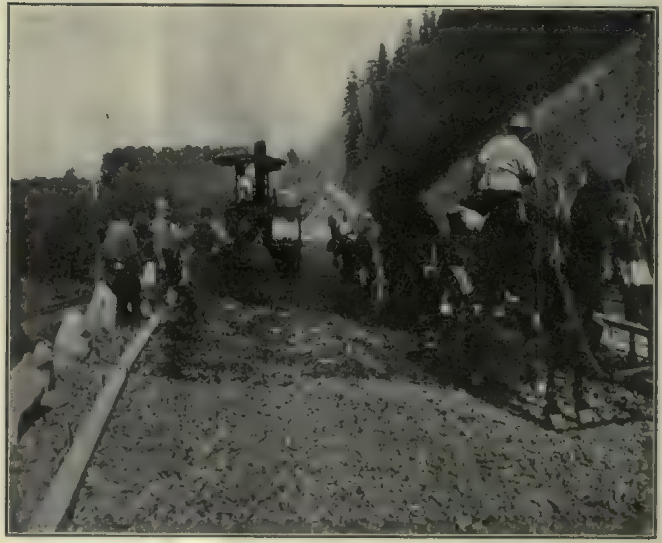

Fig. 2. Laying Asphaltic Concrete Over Stone Base

View along the Columbia River Highway, Oregon State Highway, showing spreading and rolling of Warrenite pavement (in background) and 4 in. compressed stone base (in foreground). The Columbia River Highway from the Dalles to Seaside, a continuous stretch of 215 miles, is paved with the Warrenite type of construction either on asphaltic concrete base or compressed stone base—the latter type predominating.

The impact of fast-moving vehicles is the all-important factor that must be met to a maximum degree if road surfaces are to last a long period of years. Continual jarring of any rigid mass is known to cause the "fatigue'' or breaking down of the mass, similar to the crystallization of steel; and the increased use of yielding bases, such as asphaltic concrete, for bituminous pavements is inevitable. The life of bituminous surfaces is greatly extended by the resistance to impact afforded by the somewhat ''yielding'' base; and as traffic increases the importance of protection from injury caused by impact, increases proportionately. (See Fig. 5.)

Asphaltic Concrete As a Base

The increased use throughout the United States of asphaltic concrete base warrants our putting forward a few pertinent questions and answers regarding asphaltic concrete as a base for bituminous pavements.

1. *What is asphaltic concrete base, nicknamed ''black'' base?* It is carefully proportioned gravel or crushed stone mixed with sand in proportions of about two parts stone to one part sand, dried, heated and mixed in a paving plant with sufficient melted asphalt to coat and tenaciously cement together the sand and stone when hauled to the roadway, spread and thoroughly rolled with a ten-ton road roller.

2. *Has it adequate supporting power?* Its ability to support traffic has been demonstrated for many years in different parts of the United States, commencing in Washington, D. C., over forty years ago, and in California twenty-five years ago. Large yardages have given successful service both on country roads and on city streets for over ten years, under varying climatic and subsoil conditions, including over one hundred cities or counties on the Pacific Coast—British Columbia, Washington, Oregon, and California.

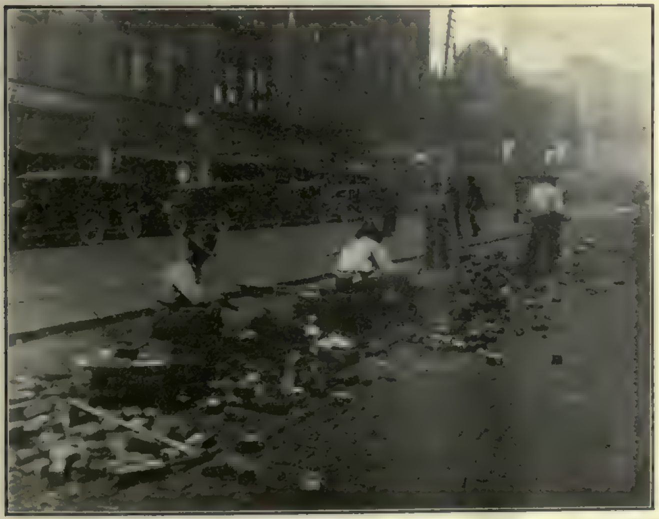

FIG. 3. LAYING ASPHALTIC CONCRETE OVER A BRICK PAVEMENT

Pacific Avenue, Tacoma, Wash., showing readjustment of the old brick pavement preparatory to laying the 2-in Warrenite-Bitulithic as a resurface over the worn out brick. The Warrenite surface already laid is shown in the background of the photograph. This pavement was laid without obstructing traffic.

3. *What other attractive qualities does ''black'' base have?* The bituminous wearing surface is laid while hot upon this asphaltic concrete or ''black'' base and is welded to and becomes an integral part of the base, thus forming a monolithic pavement from top to bottom without any line of separation between the top or wearing surface and the base. This complete union of the top and the base makes the total pavement more stable and less susceptible to displacement by traffic.

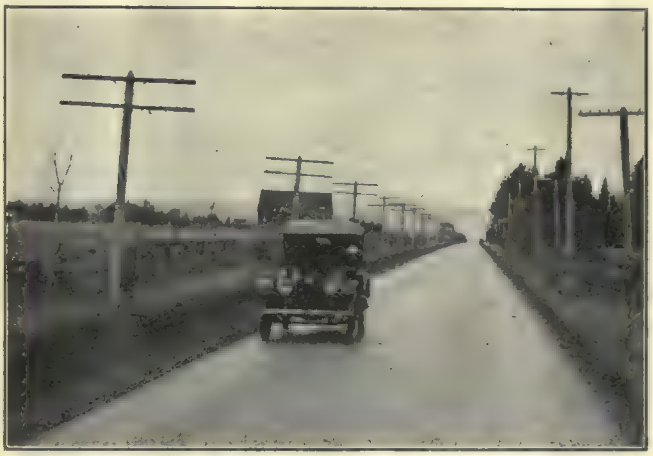

FIG. 4. A CONCRETE ASPHALT PAVEMENT SEVEN YEARS OLD

The Fairview-Gresham Road, Oregon, laid in 1916 with Warrenite Pavement on macadam base is still in fine condition. The photograph was taken March, 1922.

4. *Is absolute rigidity a desirable thing in pavements?* Such rigidity as is inherently the nature with hydraulic concrete is not desirable as a base for pavements because, owing to its brittleness and complete lack of flexibility, hydraulic concrete is known to crack and disintegrate under the frequent expansion and construction due to changes in temperature between night and morning of the same day, as well as the range from 40 deg. fahr. below zero in winter to 95 deg. fahr. above in summer in some latitudes where pavements are laid.

5. *Wherein is ''black'' base superior to a rigid base?* ''Black'' base affords adequate supporting strength but is at the same time resilient. It takes up the blows of passing vehicles by slight compression and springs back to its normal thickness just as does a solid rubber ball when struck by a bat. ''Black'' base, due to its rubbery nature, is water-proof, and, as above described, affords a union with the wearing surface that makes the top and base a uniform, dense, strong, yet resilient mass. ''Black'' base is so tough and dense that expansion and contraction do not crack it or let the surface waters into either the asphaltic wearing surface or the asphaltic concrete base. In constructing country roads with ''black'' base, the construction of detours is not necessary, as the pavement can be used as soon as laid. On city streets it does not interfere with business and does not deprive the people of the use of the street for an indefinite period.

6. *In what other particulars does ''black'' base excel for modern traffic conditions?* In that, if the sub-grade has not been uniformly and thoroughly compacted at every point, or if drainage has not been adequately afforded at any place, then if traffic causes local subsidence or a depression in the roadway, the ''black'' base

bends or sags downward with the yielding subsoil but does not crack or break up as is the case with the non-flexible, rigid bases or in the case of rigid pavement surfaces.

Asphaltic Concrete Road Surfaces

We have discussed the advantages of bituminous pavements without specific reference to types of bituminous road surface. Considerable areas of so-called asphaltic concrete surfaces have been laid using what is known as "topeka" mixture, topeka being a mixture of aggregate and asphalt, all the aggregate passing a ½ in. screen, but about 75 per cent passing a sand screen of 1-10 in. mesh. There have also been considerable areas paved with a modified topeka, containing slightly more ½ in. material than above indicated. In all of these pavements the mortar content predominates, and they cannot properly be called asphaltic concrete in the true sense of the term.

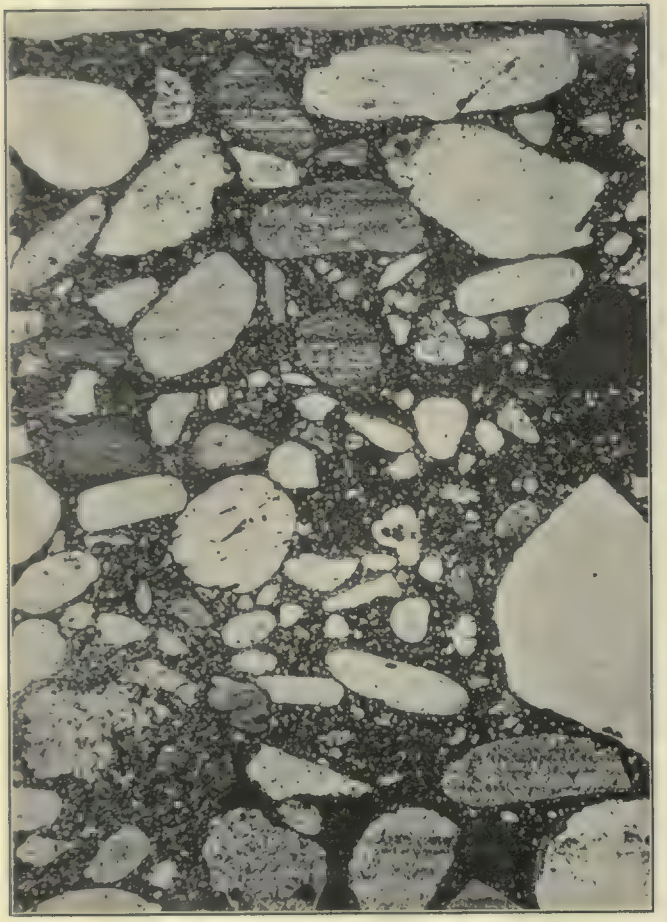

Fig. 5. Vertical Cross Section of 2-in. Warrenite-Bitulithic Pavement on 3-in. Dense Bituminous Concrete Base

It is well here to review the definition of asphaltic concrete as adopted by the American Society of Municipal Improvements:

> "Bituminous concrete is a pavement consisting of broken stone and sand, or fine mineral matter, cemented together with a bituminous cement, and which has all its indredients mechanically mixed before being laid. *To be termed a bituminous concrete it must partake of the well-known characteristics of concrete, that is, there must be stone enough in its composition to form an important part thereof and add to its strength and durability; also there* must be enough of the mortar constituent, that is, the sand and bituminous cement, to properly support and bond together the largest particles."

The area of these fine mixture pavements above referred to is small compared with the large percentage of true asphaltic concrete in Canada and the United States, which have generally been designated as the Warren type. Warren Brothers Company has been prominently identified in the development of bituminous road construction for the past twenty-five years, and the present pavement known as the Warren type of asphaltic concrete has advanced to a high state of perfection, a construction having been evolved to meet the changed traffic of the day. The evolution of the Warren type of asphaltic concrete pavement to meet the impact and thrust of modern traffic will be of general interest.

The value of 1,072 issues of bonds sold in the sixteen southern states in the first eight months of 1922, as reported weekly in the financial news columns of the "Manufacturers' Record" amounted to $224,618,365. Of this roads, paving and bridge bonds continue to hold first place in the vale of securities marketed, the total for August being 33 issues of $8,815,000 par value and 333 issues of $6,455,000 in July. The total number of issues sold for this work in the first eight months of 1923 is 343, the par value of which is $86,436,650.

Of the total representing bonds for building roads and bridges, $25,436,750 was to carry forward this class of work in Texas, while $25,202,500 is the value for like work in North Carolina. Florida, with the sale of 32 issues amounting to $6,036,000.

	NUMBER OF BONDS	VALUE OF BONDS
Alabama	10	$4,830,000
Arkansas	19	2,619,500
Florida	32	6,036,000
Georgia	13	2,906,000
Kentucky	6	1,193,000
Louisiana	29	3,786,500
Maryland	15	2,319,000
Mississippi	13	1,821,000
Missouri	10	1,846,000
North Carolina	54	25,202,500
Oklahoma	10	1,073,400
South Carolina	23	3,262,000
Tennessee	19	2,034,000
Texas	77	25,436,750
Virginia	9	1,390,000
West Virginia	4	681,000
Totals	343	$86,436,650

Drainage As an Aid to Better Roads

By ROY J. RANDALL

THE most important factors to be oonsidered in the improvemnt of highways are foundation and drainage, and in rare cases can good foundation be obtained unless sufficient drainage is provided.

The effects of erosion are apparent wherever one views the landscape. The effects of frezing and thawing may be found throughout the mountains and plains. Circulating ground waters gather up the precious metals in the rocks and deposit them in fissures, forming veins of ore. Water turns the massive machinery of our power plants and floats the giant ocean liners. In short, water is at once the most destructive and the most useful agent in the works of man.

The Importance of Side Ditches

The first item in road drainage is the side ditches which parallel the traveled way on either side. These must be dug deep enough to care for the storm water which falls on the road and is carried into them by the slope from the crown to the shoulder, also the run-off from adjacent fields. They must not be so deep as to be a menace to travel. They must be built so as to prevent wash and yet must have sufficient grade as will avoid deposits in the ditch so that it would eventually fill up. On steep grades where the road runs from cut to fill section, these side ditches should be extended far enough below the toe of slope of the fill to prevent undercutting. Where the grade of the side ditches is so steep as to cause scour, they should be paved with rubble stone. On side-hill work where the run-off might overflow the side ditch, an intercepting ditch should be built well above the road cut, to carry this run-off into the natural cross-drainage.

Bridges, culverts or siphons are required at all points along the road where there is a natural cross-drainage, such as streams, swales, arroyas, etc., and at all sags in the profile, established drainages or irrigation ditches. On long grades, culverts should be placed at proper intervals to carry drainage across and away from the roadway and prevent overflow or wash in the side ditches. Omission of openings for drainage at proper places is detrimental to the highway, not only because of the inefficient drainage provided, but also that the drainage scheme of the highway becomes recognized in the development of the territory, and improvements are erected in conformity to this scheme. It often happens that additional openings are found to be necessary to properly drain established highways running through well settled districts and this often results in annoyance and expense to property owners, which might have been avoided had these openings been provided when the highway was first constructed.

In designing a highway, careful consideration must be given to the size of openings of drainage structures. Many factors enter into the problem and each must be given proper weight in arriving at a solution. In the case of openings large enough to demand a bridge, the clear span and height of a bridge in place should be measured and available testimony of neighboring residents should be taken as to whether the structure is sufficient. This data, however, must not be overstressed, since enterprising bridge companies often succeed in selling county road authorities bridges unsuited to the particular location. The greatest economy will be had by leaving the selection of type and the design of these structures to men in the engineering profession, whose experience and education have fitted them to handle this class of work.

Many types of culverts are on the market, each having its particular points of advantage. Cast iron, corrugated metal, reinforced concrete boxes and pipes, vitrified tile and wooden boxes are the common ones. The cast iron culvert is usually the standard of excellence by which others are compared, but is seldom used because of its excessive weight and cost.

In placing culverts, care must be exercised that they are placed low enough to allow all the water to enter and yet they must not be so low as to become filled with sediment. They must be given sufficient grade to insure a good current through them and the lower ends must be so placed as to prevent undercutting or scour on the fill slopes. They must have sufficient cover to prevent road traffic from breaking them and injury by road maintenance machinery.

Sub-Surface Drainage

Seepage and ground water must be cared for by some method of sub-surface drainage, which is usually done by placing porus drain tile in the trenches and back-filling the trench with coarse gravel or boulders. French drain is constructed in much the same manner, except that no tile is used. The grade used must be sufficient to prevent sedimentation, and breaks in grade should be avoided as far as possible. Considerable judgment must be used in selecting the size and all available data should be gathered as to the elevation of ground water and the source and amount expected. The nature of the soil and dips of strata also effect the design of this type of drainage.

Open ditches are sometimes used for drainage of swamp ground and swales. This is at best somewhat temporary, since they are liable to be filled in by material being washed and caved in; also cat-tails, water cress and other marsh grasses growing in the bottom of the ditch impede the flow and diminish their usefulness. The chief value of open ditch drainage lies in the fact that the amount of flow can be more accurately determined and a more adequate and permanent system of drainage may then be installed with economy.

Abstracted from *Colorado Highways* for August, 1922.

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CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. W. TREE, Managing Editor

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"SAFETY WEEK"

"With the constantly growing volume of traffic on our highways and the corresponding increase in accidents the question of highway safety, although considered important in the past by highway officials, is worthy of even greater consideration," states Thomas H. MacDonald, chief of the Bureau of Public Roads of the United States Department of Agriculture, in discussing the "Seven Days for Safety" to be observed October 8th to 14th.

"A very large proportion of the accidents can be eliminated by safe and sane driving," states Mr. MacDonald, "but they can be reduced to a minimum only by a combination of careful driving and the elimination of dangerous grades and curves, narrow roadways and bridges and the deadly grade crossing. In Federal-aid construction, in co-operation with the States, much has been done along these lines and every step has had the support of the public, particularly in the matter of grade crossing elimination.

"In the State of Maryland the patrolmen are required to report to the State highway department the location and cause of every accident that occurs on the State roads. The information acquired in this way is used by the department as a guide in the planning of improvements which will reduce the accident hazard. When numerous accidents are found to occur at any point the dangerous feature is eliminated even at considerable expense.

"All over the country there are points on the highways which were comparatively safe for the traffic of a few years ago, but which are now the cause of many accidents. The dangerous conditions at these points must be eliminated and each State highway department should have data available so that the elimination of the most dangerous ones can be undertaken first."

CONFERENCE ON HIGHWAY CONSTRUCTION

The second national conference on education for highway engineering and highway transport will be held in Washington, D. C., Oct. 26-28, under the auspices of the Highway Education Board. The U. S. Bureau of Public Roads is co-operating in the arrangements for this meeting.

The program will include papers and discussions of such topics as relation of highway transport facilities to national progress and national defense; the need of trained men in highway engineering; highway research; and the trend of engineering education.

There will also be meetings of a number of committees and a symposium on highway educational problems.

"Down with the blatant shouting billboard that lines the state highways, overshadowing and obscuring danger signals, scenery and other things regarded as good for man!" This will be the policy of the state of Wisconsin if the 1923 legislature can be convinced of the danger of the lurking billposter. A bill now being drafted by the state highway commission, and if it passes it will prohibit any advertising signs on public highways of the state.

KENTUCKY TO INVESTIGATE QUALIFICATIONS OF BIDDERS

The Kentucky Highway Department, through its engineer, J. S. Boggs, has issued the following statement explaining a recent decision to investigate the character of bidders as well as their bids.

"The laws of Kentucky give to the State Highway Commission the right to reject any or all bids at a contract letting, and require them in making an award to select the lowest and best bidder, the attention of all bidders being called to this in the advertisement of lettings to be held.

"For the past year, in addition to this, bidders whose work is unknown to the Department have been required to file with their proposals a verified and sworn financial statement, a list of equipment, banking reference, and recommendations from those for whom they have formerly performed work. At some of the lettings held in recent months a few of the low bids have been rejected on account of a non-compliance with these provisions of the advertisement and award made to the contractor that the commission considered the best experienced and the most responsible. Contractors who have had their bids repected for these reasons have sometimes seen fit to direct a great deal of censure against the officials of the Department and have felt that they have been mistreated in the matter of award and that preference was being given to other contractors over them.

"In defense of this policy of the Commission it is well to state that because an individual or firm is low bidder on a contract at the time of letting it is no evidence that at the completion of contract they have been the best bidder. The Commission owes it to the public in its selection of contractors to make its award to those that will give the highest type of service, that will inconvenience the traveling public the shortest period of time, and that will carry on the work with the least amount of engineering supervision.

"In order, however, that in the future there will be no further confusion in regard to the furnishing of financial statements, lists of equipment, and experience records, there will be attached to each proposal a questionnaire which, when properly answered will bring out not only the financial standing of the bidder but his past record as well. Any bidder not filling out this questionnaire will have his bid disqualified just the same as if he had failed to properly fill out the items embraced in the proposal.

"When it is shown that a bidder is not qualified to perform the work he is bidding on or has not sufficient funds to properly finance a project he will not be awarded a contract, and no apology will be made him for the rejection of his bid. The public is entitled to the best service for the money that is invests in highway construction, and such service must not be impaired by the selection of contractors not capable of properly executing the work entrusted to them."

NEVADA REACHES AGREEMENT ON NORTHERN ROUTE

On September 6, at Eureka, Nevada, there was approved by the Board of County Commissioners of Eureka County an agreement drawn by the State Highway Department wherein the state and the county agree on a revised routing for State Highway Route No. 1 across the north end of Eureka County. The matter of this routing has been in controversy between the Highway Department and Eureka County for about two years, the county having refused to approve the expenditure of county funds on the route first adopted by the State Highway Department. The subject of this location was one of the matters brought before the special investigating committee at the 1921 session of the Legislature, and which committee in its report recommended that the State continue its efforts to reach an agreement with the county. On the route first adopted by the State, and partially included in the new routing as covered in the agreement, there was constructed in 1920 over the Humboldt River a concrete-and-steel bridge This bridge was located near what is known as Shoshone Point and with the completion of about five miles of roadway will be brought into use and forever eliminate the notorious Boulder Flat. One of the conditions of the agreement is that the county shall pay to the State its share of the cost of the bridge and shall also set aside its share of the cost of completing the road from the west county-line to the Dunphy Ranch, and in compliance with this section of the agreement the Department recented calld for bids covering the work of the grading and gravel surfacing of the section from the west county-line to Dunphy, excepting a short section at Shoshone Point where an overhead crossing must be built over the Southern Pacific and for which the plans and financial arrangements have not been completed. The net length of the section being advertised is 4.38 miles and will consist of a 21-ft. roadway with a 10-ft. gravel surface except on the high fill section between the two railroads where the roadway width will be 24 feet with a 16-foot gravel surface.

Correspondence

THE questions listed below were submitted by a subscriber with a request for publication. Replies to these questions are invited and will be published.

—The Editor.

1. All manner of reinforcement is being tried out in concrete pavement. One of the latest innovations is reinforcing corners with bent deformed corner bars, costing approximately ½ cents per linear foot of road. Why isn't some form of protector tried out, as in curbs, to prevent the corners from being chipped off and disintegrating at the edge of the slab?

2. In mechanics, the resultant stresses act at a 45 deg. angle. Why isn't this simple mechanical law followed in reinforcing concrete pavement with bars by attempting to check cracks in concrete by laying main members at 45 deg. angles?

3. If above method is followed, why aren't expansion joints laid at an angle to prevent the bump that comes when both front or rear wheels strike the joint?

4. On waterbound pavement, a surface application of calcium chloride costs between 3½ or 4 cents a sq. yd. Why isn't a hardener used on concrete to harden the surface and also as a dust preventive and non-disintegrater?

5. Instead of assigning certain mixes to concrete, why isn't a certain mortar content, say 10 per cent, standardized and the mix adjusted to this mortar content depending on the voids in the aggregates used?

6. Why are roads built 16 ft. in the face of ever-increasing motor traffic when the least width should provide for three cars passing, namely, 3 by 7 or 21 ft.?

7. Why are waterbound and gravel roads still built when available maintenance costs on types of pavement show that, as a financial investment, they are a failure?

8. In concrete road construction, why isn't a homogeneous subgrade giving a like bearing power for the underside of the slab throughout required for the *entire* length of the pavement?

9. Why isn't more open-joint tile used adjacent to the pavement to keep water from entering under the pavement, thus minimizing the occurrence of frost boils?

10. Why aren't tests on "impact on concrete roads" established in all state highway departments?

FOREST ROAD BUILDING PROGRESS

Expenditures totaling $2,038,472 of national forest highway funds have been approved by the Secretary of Agriculture for the construction of forest roads in California, Utah, Washington and Wyoming. This sum is distributed as follows: California, $968,697; Utah, $280,700; Washington, $575,000; Wyoming, $214,075.

COLORADO TO VOTE ON SIX MILLION BOND ISSUE

Colorado will vote upon a $6,000,000 bond issue on November 7th, next. This money is to be used to make permanent roads in that state by improving the present roads. Plans are now being considered for increasing the revenue of the State Highway Department by additional taxes. The bond issue money will go to meet the Federal Aid money furnished by the Government, and this will insure the state some thirteen millions of dollars for roads.

BOND ISSUE OF $75,000,000 BEING URGED IN TENNESSEE

Sponsored by the Tennessee Good Roads Association, a movement is now under way for the authorization of a $75,000,000 bond issue to complete the highway system of the state. The proposed issue would be against an anticipated capitalized fund of $4,900,000, to be raised by combining the present federal-aid and state money with all of the motor-vehicle taxes and by an additional fund of $800,000 to be realized by a tax of 2 cents per gallon on gasoline.

DUNES HIGHWAY NEARLY COMPLETE

With concrete being laid down at a rapid rate and over 3,500 feet of pavement already down, every indication now points that the Dunes Highway, forming an airline route between Gary and Michigan City will be open to traffic December 1. This road will be one of the most substantial constructed this year by the state and federal government, according to John D. Williams, director of the Indiana highway commission.

Accroding to state highway officials the section west of Michigan City to the Porter road will soon be completed. It will be opened first to traffic.

RECORD ROAD CONSTRUCTION

What is considered to be a record for road building in British Columbia has recently been accomplished in the construction of two miles of concrete roadway between Langley Prairie and Murray's Corner by the A. B. Palmer Co., of Vancouver, contractors in charge of the work. On July 4 paving was started and on August 8 the last batch of concrete was poured. Materials used in the construction of the road were never placed on the sub-grade, being conveyed on auto trucks from the bunkers at Cloverdale in batch boxes, thus ensuring clean aggregates. Grading was carried ahead of the work by a new type of machine. No horses were used on the job, all the work being done by motor trucks.

DETERIORATION OF STORED CEMENT

Deterioration of cement stored in bulk is less than in bags, owing to the smaller area exposed, states the Bureau of Mines, as the result of an investigation to determine the cause of deterioration of Portland cement during storage and transportation. Hydration takes place only at the exposed surface, and the bulk of the cement is unaffected. Cement transported in bulk must be shipped in a tight, closed car and must be protected from moisture during loading, shipping and unloading, preferably it should be used immediately after unloading at the point of destination. This practice is now followed by several manufacturers and where conditions are suitable it is becoming more common as its advantages are seen. Shipping in bulk effects a saving by eliminating the use of bags, which is an important item in the cost of cement, and it should also permit a saving in freight rates.

PERSONAL MENTION

W. C. Markham, formerly secretary of the Kansas Highway Commission at Topeka, and legislative representative of the American Association of State Highway Officials, has been appointed to a position with the U. S. Bureau of Public Roads. His work will be largely that of handling relations of the federal board with the various State Highway Commissions.

E. H. Quinney has severed his connection with the South Dakota Highway Commission by which he was employed as resident engineer, and has gone into business under the firm name of the Dakota Highway & Materials Co., Watertown, S. D.

D. E. Henry, senior highway engineer of the U. S. Bureau of Public Roads, for the past two years in the offices of District 6 at Ft. Worth, Texas, has resigned to become office engineer of Division 4, California Highway Department, with headquarters at San Francisco.

Maurice O. Eldridge, who has been director of roads of the A. A. A. Good Roads Board for the past three years and in direct charge of all legislative activities of the A. A. A., has been named as executive chairman of the Association and has assumed active charge of the association's work throughout the United States.

J. C. Long, until recently connected with the Tarrant County Highway Dept., Tex., has re-entered the local office of the U. S. Bureau of Public Roads. He will be at Baton Rouge, La.

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CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. L. POWERS, Editor

E. W. TREE, Managing Editor

Vol. LXIII October 11, 1922 Number 15

TABLE OF CONTENTS

The Evolution of Warrenite-Bithulithic 125
By R. C. Davidson

The Proper Treatment of Posts for Guard Rails . . 130
By Edward F. Paddock

EDITORIALS AND NEWS:

- The Need for Trained Men 132
- Michigan State Good Roads Association to Hold Convention in November 132
- Court Ruling Halts Highway Operations in Minnesota 132
- Work Delayed on Ideal Section of Lincoln Highway 133
- Big Road Building Program Ahead 133
- Road Material Research Work Extended at Princeton University 134

EQUIPMENT—TRADE—MATERIALS:

- Haiss Creeper Wagon Loader 135
- P. & H. Super Tractor Crane 135

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII OCTOBER 11, 1922 No. 15

The Evolution of Warrenite Bitulithic

How the Asphalt Pavement Has Been Developed To Meet the Demands of Modern Traffic

By R. G, DAVIDSON

Northwest Manager, Warren Brothers Company

THE development of the paving art over a period of fifty years has been a gradual one, and it must be conceded that the perfect street pavement that will meet all demands of the public and the constantly changing traffic conditions has not yet been invented. Warrenite-Bitulithic, however, is a nearer approach to the perfect pavement than any other pavement heretofore produced, and it will be of general interest to review briefly how by successive steps, the structure has been evolved and wherein it overcomes the weaknesses of the earlier bituminous pavements.

It was found that in the early days of sheet asphalt construction that the wearing surface, which was composed of about 90 per cent of sand and 10 per cent of asphalt, and laid about 3 in. thick, if subjected to heavy traffic, did not possess sufficient stability; and, consequently, would shove into rolls and ruts under the wheels of traffic. This sand and asphalt wearing surface was thereupon reduced in thickness about one-half and was required to be laid on an intermediate, or so-called binder, course of about the same thickness, composed of broken stones and asphalt which, it was assumed, would not shove on the foundation, and that the combination of these two separate layers would withstand the stress of traffic better than a single layer of sand and asphalt.

Development of the Paving Art

After this theory of the asphalt pavement had become standard practice, F. J. Warren, in 1901, invented a wearing surface for a street pavement, and in the patent issued for this invention in 1903 he showed that where the particles of the mineral aggregate in a wearing surface were composed of grains of sand, as in sheet asphalt, the cement strength of the bituminous cement was not sufficient to withstand the stress of traffic and to hold the two layers in place; and, therefore, instead of using separate layers the wearing surface should be laid in a single layer, in which the large pieces of stone and fine mineral matter should be indiscriminately mixed from top to bottom, and, if the different sizes of stone were mixed in the proper proportions of each size, a much better and more satisfactory result would be accomplished. Surface mixtures prepared in accordance with this invention have been used in approximately eighty millions of square yards of street pavement.

Use of a Binder Course

A decided improvement had been made in the paving art when the 3-in. asphalt wearing surface was reduced in depth by one-half, and a binder course, made of coarse stone, laid between the foundation and the top course, to retard the shoving and rutting which occurred in the sheet asphalt pavement; but the two layers were kept separate and distinct and no effort was made before Warren's invention to advocate that the fine and coarse particles of stone be indiscriminately mixed in the proper proportions from the top to the bottom of the wearing surface, and thereby secure both stability and solidity.

Warren's invention was a decided improvement on the two-layer sheet asphalt method of construction; but, however accurately the different sizes of stone might be graded, and no matter how low the percentage of voids in the mineral aggregate might be reduced, as shown by laboratory tests, it was found that in the practical construction of a street pavement under his method the surface would show small voids or pores, even though the wearing surface be thoroughly rolled.

Recognizing this defect and the impossibility of avoiding it, Warren suggested that after the rolling was completed these inevitable small pores or voids in the surface be sealed, and a flushcoat of pure asphalt covered with stone chips was adopted as the most approved method of finishing a street pavement laid under the Warren patent, this method of construction being consistently followed and advocated by Warren Brothers Company until later years when an invention in 1910,

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Presented at the Canadian Good Roads Association Convention, Vancouver, B. C., June, 1922.

by one of their experts, E. C. Wallace, who had been identified with the Warren interests for over twenty years, provided a structure better able to withstand the great increase in traffic which was apparent to all students of the subject.

In the construction of the Warren pavement, experience taught us that notwithstanding the exceeding care in gradation of the different sizes of stone and despite the minimum to which the percentage of voids in the mineral aggregate was reduced, if, as determined by laboratory test, the amount of asphalt used was just sufficient to fill said voids and coat the particles, then, after the rolling was completed, more or less of the large particles of stone would necessarily show on the surface, and, being exposed to the impact of traffic, the stones would become shattered, allowing moisture to enter the stone, and the pavement would begin to disintegrate. On the other hand, if more asphalt and fine aggregate were used than was necessary to fill the voids between and coat teh larger minerals particles, then,when the pavement was rolled, part of this surplus asphaltic mortar would remain in the body of the pavement and by keeping the larger particles separated to such an extent that they could not interlock properly among themselves, compromise the maximum degree of stability of the pavement, resulting in a tendency of the coarse particles to move on themselves and causing an uneven contour, especially on grades.

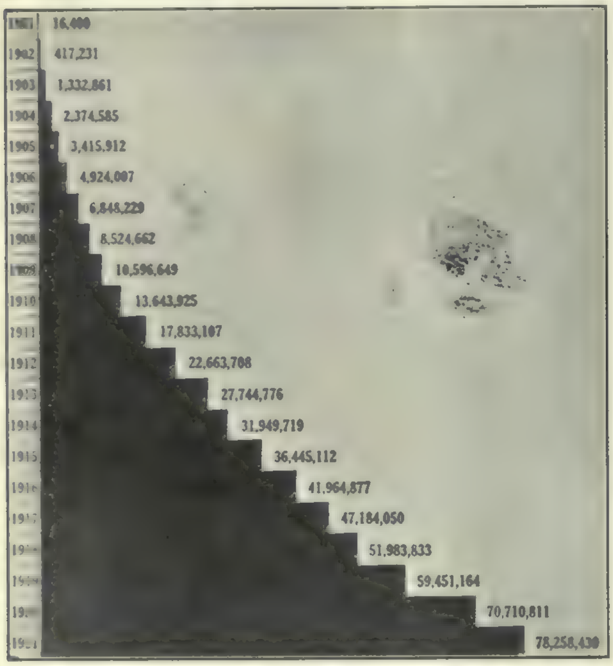

Fig. 6. Chart Showing Increased Yardage of Pavement Laid Each Year Under Warren Bros. Supervision.

After struggling with the problem for sevaral years, and after resorting to several methods to remedy the inherent weaknesses of the earlier Warren construction to meet the greatly increased traffic, the invention of Wallace was evolved and was immediately recognized to be a forward step in the building of bituminous pavements, and was adopted by Warren Brothers Company to be utilized as the increase of traffic required.

Wallace showed that the surface of a coarse aggregate asphaltic concrete could be sealed by a thin layer of fine aggregate asphaltic mixture if it was so blended and bonded with the top of the coarse mixture that the two would form a single, compact, integral layer. This was a most decided improvement and a radical departure from all previously known bituminous pavements, because, in addition to thus providing a dense, compact, plastic, protective covering for the coarse stones, it utilized one of the fundamental principles of the old macadam construction by forcing enough of the fine mixture of the upper course down into the spaces between the uppermost coarser particles of the coarse mixture to give the tops of said stones the lateral support which they needed to prevent displacement by traffic.

The Evolution of Warrenite-Bitulithic

When the words "bitulithic" and "warrenite" were applied to road surfaces for city street and country highways by their inventor, the late F. J. Warren, the traffic was composed almost exclusively of the horse-drawn vehicles, and the heavy fast-moving motor car or truck was in the pioneer stage of development. The name "warrenite" was intended to apply to country roadways and the specification therefor covered a lighter construction than that suitable for city streets, the latter being developed under the specification known as "bitulithic."

Due to inadequate attention prior to the building of the pavement, the highway must meet more difficult drainage conditions and must sustain as heavy or heavier traffic than heretofore obtained on city streets. Also, due to fast-moving vehicles the highway must resist a greater thrust and impact. While the volume of traffic on city streets is the important consideration, the highway must sustain the severe test of traffic in narow lanes and mainly in one direction, and this without the assistance of being ironed out by cross or distributed traffic as was the case on city streets. To-day, even on city streets, traffic is becoming less distributed owing to the large number of automobiles in use, and the parking of the cars either along the curbs or in the center of the thoroughfares; consequently the traffic on city streets is often confined to narrow strips or lanes in one direction similar to the narrow highways.

This change in the quantity, velocity, weight, and confined-to-one-line traffic made necessary a departure from the practice in the building of the Warren pavement, in order to resist to a maximum degree the destructive action caused thereby; and the specification of Warren Brothers Company of today, under which the names "Warrenite" and "bitulithic" are merged into "Warrenite-Bitulithic" for use on both city streets and high ways, marks an epoch in the perfecting of the bituminous road surface that is no less significant to the future of road-building than the invention of Warren twenty years ago, when he discovered the importance of inherent stability and low voids, with the accompanying elimination of cracking of the pavement and rotting in the gutters of the old-style sheet asphalt pavement and the defects of the old tar macadam layer pavements from which, to better meet the traffic of that day, the original Warren pavement was evolved.

As the invention of Warren in 1901 was the result of years of preparation and study in the building of sheet asphalt pavements through careful, constructive laboratory work, so Warrenite-bitulithic is the result of the best thought of experts who have been observing, through laboratory research and field study the changes of traffic and its effect on the road surfaces constructed unde rthe supervision of Warren Brothers Company laboratory during the past twenty years in over 500 cities and counties in the United States and Canada, and including every state and province in these two countries, ad in many foreign countries, under a wide range of climatic conditions. It is only natural, under such opportunities for observation and study, that a roadway should be evolved having characteristics to better meet the traffic of the present day. (See Fig. 6.)

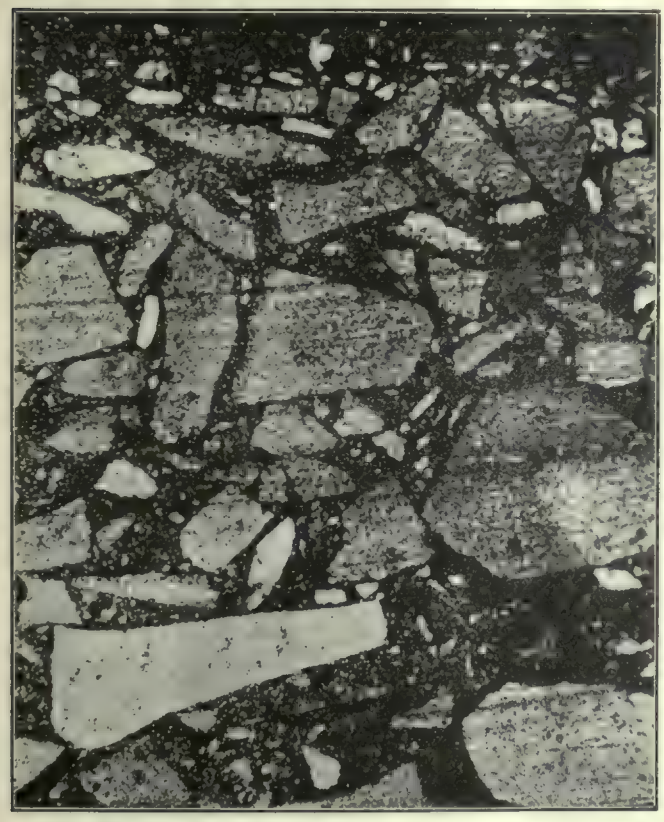

Fig. 2. Cross Section of Pavement Showing Shock-Absorbing Protection Master

This cross section of pavement shows how the excess mortar has worked out under traffic from between the stones to the surface of the pavement providing by accident, a shock-absorbing protection to the coarse aggregate—a condition which is now accomplished at the outset by the Warrenite-Bitulithic construction.

It is recognized that in isolated cases of these earlier pavements the wedging of the coarse aggregate has, under gradually increasing and distributed traffic, crowded the excess mortar to the surface of the pavement, without the coarse stones moving on themselves to a degree that has resulted in an unsatisfactory contour. There are also instances where the gradually increasing and well distributed traffic, combined with the effect of the sun's rays during long years of service, has accidentally produced in the structure apparently the very thing that is accomplished at the outset by the construction which is the subject of this paper, that is to say, at the time the road was completed the traffic was not sufficiently heavy, either in total volume or in weight of individual loads, to produce strains in the pavement greater than it could sustain without deformation, notwithstanding the presence of an excess of mortar between the stones in the body of the pavement. However, the effect of the kneading action of traffic in warm weather was to force the stones downward, wedging them more closely together and squeezing the excess mortar upward, thus daily slightly increasing the resistance of the aggregate to displacement and, where the increase in traffic was gradual, it automatically produced an equivalent increase of stability in the pavement and finally formed a shock-absorbing, protective mortar or mastic over the stones. (See Fig. 7.)

The Effects of Traffic

Where time and traffic have worked this transition without displacement of contour, the surface has shown a higher resistance to impact and thrust of modern traffic than any of the pavements laid under the original Warren methods; but the result was accidental and cannot be systematically reproduced by those methods under the increased traffic conditions to which a newly laid pavement is immediately subjected to-day.

The above explains why many of the older pavements have gradually improved with age through a change in the juxtaposition of the coarse and fine particles, and why they are to-day standing the ravages of the present-day traffic, while a pavement constructed today identical in every particular as to proportions of materials, specifications and methods of laying, does not withstand traffic without displacement.

However, by following the methods specified for laying Warrenite-bitulithic, we are now able to design and to produce in the original construction the form of structure needed to resist the destructive forces of modern traffic, because the protection from abrasion and impact afforded the stones by the fine aggregate rich bituminous mixture at the immediate upper surface, permits the use of a coarse aggregate bituminous concrete for the lower portion which contains a minimum of mortar and a maximum of interlocking of the stones, imparting a maximum of stability to the whole mass.

The traffic of to-day differs from earlier traffic in the following respects:

1. Being over ten times greater in quantity.
2. Practical elimination of horse-drawn vehicles.
3. Increase in velocity of the motor-truck or car over that of horsedrawn vehicles.

4. Concentrated traffic. The highways are now 16 to 20 ft. in width, and the traffic is, consequently, confined to narrow strips in one direction.

Under these changed conditions, we have referred to a tendency for the particles of aggregate to become displaced; and, under exaggerated conditions of traffic, particularly on grades, bituminous pavements have shown a tendency to rut or creep under the thrust of the fast-moving motor-car. In order clearly to understand how the Warrenite-bitulithic road surface overcomes this tendency, we must review the practical application of Warren's invention of inherent stability and low voids in the bitulithic pavement, under which name this invention was put on the market.

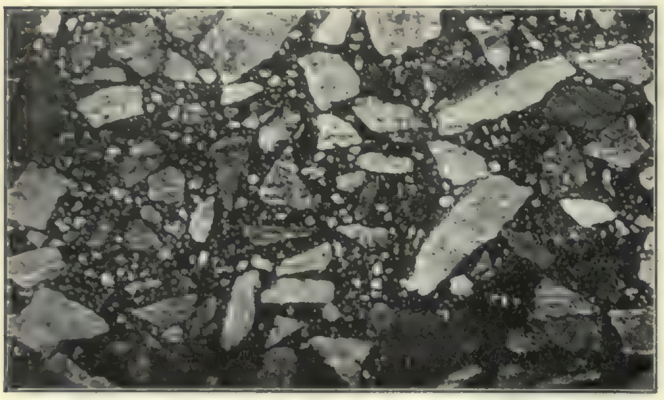

FIG. 8. VERTICAL CROSS SECTION OF PAVEMENT USED AS RESURFACE OVER OLD CONCRETE.

This cross sectional view illustrating the surface pores filled with asphalt where the liquid flush coat is squeezed to the surface, causing a sticky condition and requiring resanding. The jet black in the surface pores is the pure asphalt.

Warren realized that where coarse aggregate is used in the 2-in. asphaltic concrete mixture there are bound to be chinks or creases in the surface after rolling that must be grouted or filled; otherwise there would be an opportunity for moisture to be trapped in the surface. As all stones are more or less absorbent if not protected by the coating of bituminous cement, it was of course desirable to avoid any absorption of moisture or acids in the immediate surface of the pavement where the moisture came in contact with it; and since this part of the pavement is subjected to the direct action of traffic some protective coating is all the more desirable. In adopting a specification for bitulithic pavement, which was the name Warren applied to the highest type of construction which he was able to evolve under his invention of twenty years ago, he included the use of a pure liquid bituminous cement flushcoat or squeegee coat. This flushcoat was spread over the surface of the surface mixture in order to fill any surface chinks and seal the immediate surface against the action of moisture, which otherwise might work into the stone by absorption or enter the pavement through any chinks where the stones came together in the surface with insufficient mortar at that point to squeeze up and "close up" the surface. (See Fig. 8.)

As the liquid flushcoat did not produce a satisfactory surface finish, being very slippery when it was cold and sticky when it was hot, provision was made for spreading hot stone chips over the liquid flushcoat while the latter was still warm; and the liquid flushcoat and the chips constituted the surface finish of the pavements laid under the names bitulithic and Warrenite. It was intended that the rolling during construction, plus traffic, would crush and incorporate the chips into the asphaltic cement and thereby give a body to the otherwise pure asphaltic cement finish, and make it tough and less brittle. That this was very imperfectly done was evidenced by:

1. The early disappearance of the surface finish, leaving the stone in the rolled surface aggregate exposed to the shattering impact of traffic. (See Fig. 9.)
2. The necessity for resanding of the pavement, due to an excess amount of liquid asphalt on the surface of the pavement making the immediate surface sticky and objectionable to both pedestrians and vehicles, and making a re-application of the chips or sand necessary to temporarily remove the nuisance. In many cases, it was necesary to re-apply the chips and sand in successive years. (See Fig. 10.)

Not only was the re-application of these chips or the sand an expense to either contractor or city, but the accompanying dust-nuisance—both when the original pavement was thrown open to traffic and whenever resanding became necessary—gave rise to criticism, especially on heavily travelled thoroughfares. In order to overcome these weaknesses, it seemed desirable to use a wearing surface mixture containing sufficient fine mor-

FIG. 9. SURFACE OF A BITUMINOUS PAVEMENT SHOWING SHATTERED STONES.

This condition is due to inability of the "Flushcoat and stone chips" surface finish to protect them from impact or blow of traffic.

tar to produce a smooth "closed-up" surface under the roller, so that less flushcoat bitumen would be needed to seal the surface chinks.

Maximum degree of stability and lowest percentage of voids in the aggregate require that the large and smaller stones touch each other with only sufficient asphaltic mortar between the coarser particles to fill the spacec between the stones without crowding them apart. Such a mixture, however, was found to have a more honey-combed surface after compression than was desirable. Such a mixture failed to "close up" under the roller, there being only sufficient mortar to fill the spaces in the coarse aggregate, and not an excess to squeeze up under the rolling to produce a "closed" surface. On wide streets, allowing distribution of traffic over the entire width, and with the class of traffic which prevailed during the earlier development of the bitulithic pavement, this excess mortar or mastic produced no apparent defect in the construction, and the pavement had a degree of stability sufficiently high to meet the traffic of the day. But, under the increased impact and thrust of motor traffic and the narowing of the lanes of traffic on the highways, resulting in the confining of the increased traffic to one place, there was brought about a new condition which required a change in the construction to overcome to a maximum degree the tendency towards rutting of the road and the tendency to ship on grades.

"Warrenite-Bitulithic"

It was found by an examination of pavements that had rutted or shifted under extreme conditions of traffic that the excess, asphaltic mortar, content, which was put into the mixture (to "close" it on the immediate surface) over and above that required to fill the spaces between the coarse stones, resulted in crowding the large stones in the mixture slightly apart, as a portion of the excess mortar content was distributed through the mass. This excess mortar content, or mastic, permitted a slight movement of the coarser stones on themselves, and yet the excess flushcoat could not be reduced by any other then known way of laying the pavement than by using the excess mortar content in the surface mixture itself. Here was a dilemma. Either we had a pavement with a maximum degree of stability and lowest voids, having a coarse open surface which would take excess flushcoat with its serious consequences decribed above; or the mixture, while constructed with low voids and a high degree of stability in the aggregate as compared with other forms of bituminous pavements, would not have the maximum degree of stability so essential to meet the thrust of present-day traffic. To meet these traffic conditions Warren Brothers Company have made the herein described changes in their method of building road surfaces which have now been generally adopted as the Warren type of construction known as Warrenite-bitulithic."

Instead of making the liquid flushcoat a part of the construction, with its consequent accompanying sacrifice of maximum stability in order to get a "closed-up" mixture, and to minimize the sticky surface and dust nuisance, the improved construction abandons the liquid flushcoat, and provides a construction of the wearing surface by first spreading the coarser mixture with only sufficient mortar content to fill the spaces or voids between the coarse aggregate, thus retaining in the coarse aggregate a maximum degree of stability or resistance to displacement; and, immediately thereafter, spreading a rich, plastic, shock-absorbing asphaltic mortar over the coarse mixture sufficient in quantity to thoroughly cover the stable, coarse aggregate mixture. The two mixtures —the fine mastic, with its underlying coarse, stable aggregate—are blended together by compression whereby they the bonded, resulting in a pavement consisting of a flexible, mallable, mastic top, to take the impact and shock of traffic and protect the coarse stones from abrasion, blended into the underlying coarse aggregate mixture, with its maximum degree of stability to resist displacement, and effectively wedging the coarse stones and, through the lateral pressure thereby created, giving to the tops of the stones the lateral support which they need to prevent movement under the thrust of the fast-moving vehicle.

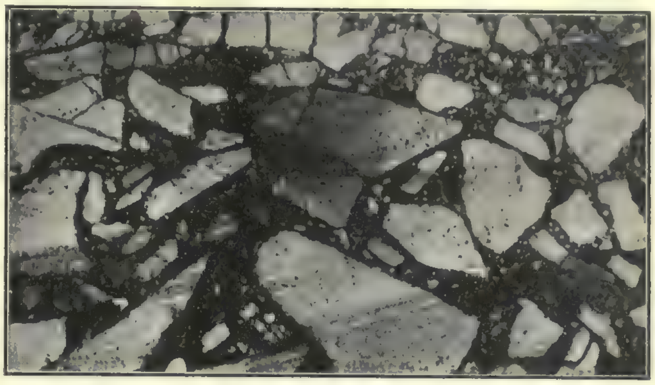

FIG. 10. VERTICAL CROSS SECTION OF EARLIER BITULITHIC PAVEMENT.

This view shows a shattering of the uppermost stones by impact of traffic. This is prevented by present method of protecting the stones by the "Fine Surfacing Mixture."

In this construction, the fine surfacing mixture or mastic is accurately proportioned, mechanically mixed and uniformly distributed over the coarse aggregate, whereas, under the earlier construction traffic was mainly depended upon to force the sand or stone chips into the liquid flushcoat. This the traffic did more or less ineffectively, depending upon the amount of traffic and the weather conditions during which the traffic was applied. (See Fig. 1.)

The rich mastic flexible top blended into the coarse aggregate, whereby it is bonded into one integral mass, densest at the top, must not be confused with the ordinary and mixture in an ordinary asphalt pavement as laid on the older binder course. If such a rich mixture were laid to approximately the thickness of sheet asphalt wearing surface, vehicle wheels would badly rut and displace it. In the fine surfacing mixture of the coatings

(Concluded on Page 136)

The Proper Treatment of Posts for Guard Rails

By EDWARD F. PADDOCK

Protexol Corporation

GUARD rail posts are exposed to particularly severe conditions and are subject to a number of dangerous and very contagious diseases known collectively and indiscriminately as rot or decay. Rot in timber is caused by the presence of fungi, or as they are more commonly called toadstools or mushrooms. These are plants of a low order that grow not on but in the wood. Like other plants, they grow from seed, but from seed so small as to be invisible to the naked eye, except in masses. These seeds or spores are in the air at all times and are washed down by the rain or dew, so that the moisture that comes in contact with posts is full of them.

When one of these spores is deposited on a piece of wood, under suitable conditions it germinates and begins to grow in the wood, sending out a network of threads which find their food in the substance of the wood, just as a plant takes nourishment from the soil. To all outward appearances the wood is unchanged, but beneath the surface the fungus is taking away certain constituents of the wood and leaving it a mass of soft material that we know as rotten wood.

Four Conditions Necessary for Decay

When the fungus reaches maturity its next business is the reproduction of its kind and it is only then that we become aware of its presence. It begins to bear fruit. This fruit appears on the surface of the wood in the form of toadstools, mushrooms, punks or conks, which soon begin scattering seeds by the million and the process begins again.

Like all other plants, fungi require moisture, air, a suitable temperature and food. Remove any one of these essentials and the fungus cannot develop. In the case of guard-rail posts, however, these conditions are not within our control. The post is set in the ground where it is almost continually damp and where the moisture in the wood has little chance to evaporate. It is exposed to the air above and often for some distance below the ground line. Our climate furnishes temperatures that are suitable for fungus growth. There remains only the food supply and this being the post itself, cannot be removed. The only thing left for us to do is to prevent fungus spores from coming in contact with the wood, or to so poison the wood that fungus spores coming in contact with it will not germinate. This is the business of the wood preservative, to form an unbroken antiseptic zone about the wood or at least such a portion of it as is unprotected and would provide suitable soil for the development of fungi.

The simplest form of wood preservative is paint. If the wood is free from fungus and fungus spores, which it rarely is, a coat of paint will keep new spores from reaching the wood and so prevent rot just as long as the coating of paint remains whole and unbroken, but no longer. As soon as the paint film is scratched through or broken in any way, fungus spores can reach the wood and do reach it as we all know, for painted wood does rot, and when decay has once started all the painting we can do will not help it.

Only a little better than painting is the coating of the wood with hot tar. The only advantages that this has over painting are that the heat of the tar when applied may kill any fungus or fungus spores that lie at or near the surface of the wood and being applied hot, a little of the tar will penetrate the outer cells of the wood and so make it a little more difficult to break through the protective coating. When the tar cools, however, it is easily cracked or injured and then decay can start.

Another method of preventing decay has been repeatedly tried and it appeals on account of its simplicity. I refer to charring. It was thought that by subjecting the outer portion of the wood to fire, not only the fungus in it would be killed but that the outer portions of the wood would be partially distilled, leaving preservative materials in the wood. This sounds very plausible but experience has repeatly shown that not only will charred wood decay very readily, but further, that the substances distilled from wood and known as wood tar and wood tar creosote have very little preservative value even when used in far greater quantities than are produced in charring the wood.

How Decay Can Be Prevented

It appears then, that in order to prevent decay we must in some way poison the outer portions of the wood so that fungi will not grow in it and so that this protective antiseptic zone may not easily be broken. This means that the preservative must enter the wood deep enough so that ordinary wear will not break through and expose untreated wood. It means further that this preservative material must be of a permanent nature so that it will remain in the wood after it is put there.

Probably the cheapest and simplest preservatives are metalic salt solutions, such as copper sulplate, mercurie chloride, zinc chloride and sodium fluoride. These are all soluble in water and are applied in water solution. They are injected into the wood under pressure or absorbed by immersion in baths of the preservative. After the treatment the water evaporates, leaving the preservative salts in the wood.

This is all very well for wood that is to be used in comparatively dry situations, but where the wood is to be embedded in the ground and will be in contact with earth that is damp for the greater part of the time, they have not proven successful. Under such conditions the process known as leaching takes place, whereby the salts

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Abstract of a paper presented before the New Jersey Highway Association.

are gradually dissolved in the moisture of the surrounding soil and carried away from the wood so that in a comparatively short time the preservative disappears from the wood leaving it unprotected.

There is, however, a class of preservatives that are only very slightly soluble in water and which at the same time are extremely poisonous to fungi. These are the heavy oils distilled from coal tar and known as dead oil or creosote and green or anthracene oil. Many years of experiment and actual experience have demonstrated the efficacy of these coal tar distillates so that to-day they are recognized as the very best means of prolonging the life of wood under all sorts of conditions of exposure.

Now just what are the conditions that a guard-rail post must meet, as far as decay is concerned? First, it is set in the ground so that the lower three feet of it are surrounded by earth. As we know, earth, even in well drained sand, never dries out more than a few inches below the surface, so that the post below the ground line is kept continually moist. The exposed upper part of the post has plenty of air but remains dry. The earth in which the butt of the post is embedded is sufficiently porous to provide an air supply to the post for some distance below the ground line. In clay, this may be only an inch or two, while sand or gravel may be sufficiently porous to allow air to reach the very bottom of the post. Where the posts are shaded by grass and weeds, they frequently remain damp for several inches above the ground line. We see then that just above and below the ground line there is a zone where fungi have just the conditions necessary for their development and that this zone may extend slightly above the ground line and may include the entire lower end of the post.

The Coal Tar Preservatives

The coal tar preservatives of which I have spoken consist of a very complex mixtur eof chemical compounds. Some of these compounds evaporate readily and consequently do not remain long in the wood, while others are of such high boiling points that they will practically not evaporate at all at ordinary temperatures, or even at the temperatures used during treatment. Here then is the difference between creosote and anthracene oil. Creosote contains a larger proportion of volatile constituents while anthracene oil consists almost entirely of nonvolatile oils that remain permanently in the wood. It would seem then that when creosote is used as a preservative we must anticipate that a large portion of it will disappear when it is exposed to the air. Experiment has proven this to be true and also that the portion that does remain permanently to preserve the wood, consists of the high boiling nonvolatile oils, the anthracene oils.

In the preservation of railroad ties, about a gallon of creosote per cubic foot or, roughly, a pound and a half per square foot of lateral surface is found to be necessary to insure proper protection. This is forced into the wood by means of pumps in a tight cylinder. Obviously the entire surface of the wood is treated. In the case of guard-rail posts this is out of the question, because for several reasons the surface of the post above the ground must not be oily. If it were, it would be impossible to paint it white, for the creosote would quickly destroy the color. If it were oily, it would soil the clothing of anyone coming in contact with it. Since it is exposed to the air it is for the most part dry and will not readily rot, so that one-half of the treatment would be wasted.

Methods of Treatment

Our treatment then must be confined to such portions of the post as are exposed to decay. Two methods of application present themselves, brushing and immersion in an open tank of the preservative. Obviously, it is impossible to put a pound and a half of creosote or anything approaching this quantity in every square foot of surface with a brush. With open tanks it is possible but only by means of treatments lasting so long as to make them impracticable. Where any appreciable amount of posts are to be treated this means days or weeks of labor or large tank capacity both for treatment and storage of preservative.

This brings us to the anthracene oils which on account of their nonvolatile nature remain permanently in the wood and which consequently can be used in much smaller quantities to obtain the same results. The higher the specific gravities and boiling points of these oils, the more permanent they are and the less is required for preservation.

Comparable tests of anthracene oils, creosote and other preservatives have invariably shown the superiority of the high boiling permanent oils. Such tests have been performed not only in this country but in France, Austria, Germany and India with always the same result.

For guard-rail posts I would unquestionably recommend what is known as the "hot and cold" double immersion treatment. The apparatus necessary consists of two tanks about 3 ft. in diameter and 4 ft. 6 in. deep. The bottoms of these tanks should be protected from injury by laying piece of "I" beam or rail in the bottom. One of these tanks should be provided with steam coils or be so mounted that a fire may be built beneath it. The other, which is for the cold bath, should be provided with a draining platform on which the treated posts may be stood to allow the surface oil to run off and be returned to the tank. Such tanks as these are readily portable and may even be mounted on a steel truck so that the treating may be done either at the storage yard or on the job.

The process consists in filling the tanks to such a depth, that while the posts are being treated they will be covered to depth of 3 ft. 8 in. The oil in the first tank is heated to about 180 deg. fahr., and held at this temperature throughout the treatment. The posts should be kept submerged in this bath for twenty minutes, then removed and immediately placed in the second tank containing the cold preservative. They should remain in this tank for ten minutes and finally removed

(Concluuded on Page 136)

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE NEED FOR TRAINED MEN

An overnight demand for trained men far in excess of proper qualified applicants has resulted from the rapid growth of the newest of the engineering arts, highway construction, says the Highway Educator Board, although highway engineering is taught in approximately 130 educational institutions in the United States. In many of these institutions, however, the course is admittedly inadequate. It is the purpose of the Board to bring these educational institutions into touch with the latest developments of the art, and through methods to be devised at the forthcoming conference, to keep highway engineering courses abreast of approved and modern practices.

Demand for highway engineers comes from state and federal organizations and bureaus, from municipalities —latest figures show that there are approximately 80,000 town and city engineers and officials whose duties are similar to those of such engineers—from highway contractors and industries making road-building materials.

More highway engineers will be wanted to meet the demands of the road-building program within the next fifteen or twenty years than the colleges at present are turning out for the entire structure of the American highway system, with the exception of the roads built or commenced during the past six years, is yet to be built. Opportunities for men of right training, in the Board's opinion, will continue for many years, as numerous as they are to-day.

Roads are seen the most, used the most, and needed the most of any public utility. It is natural that they should be talked about because they are continually in evidence. Every now and then we hear criticism of the road-building program. Now criticism is one of the most necessary requisites of success providing it is intelligent and constructive; but criticism that has no basis in fact is, to say the least, destructive and detrimental. While a well-aimed shot may bring down the proper objective, a stone thrown at random will do much damage and no good. If you want your criticism to do good, be sure you know the facts. Think before you speak.—"Nevada Highway News."

MICHIGAN STATE GOOD ROADS ASSOCIATION TO HOLD CONVENTION IN NOVEMBER

One of the most important of the annual conventions of the Michigan State Good Roads Association is to be held in Grand Rapids, November 221, 22 and 23 at which time the matter of legislation to be proposed relative to road construction and maintenance will be taken up. P. T. Colgrove, president of the Association, has expressed the opinion that this will be the most important of all previous conventions of the Association and it is his purpose to make it the biggest and best.

The arrangements of the details of the convention will rest with the Kent County Road Commissioners, consisting of Warren R. Townsend, Alvah Brown and Royal V. McArthur in co-operation with county engineer O. S. Hess.

The program planned is an extensive one. One session will be under the direction of state highway commissioner Frank F. Rogers and the division heads of this Department, and another will be under the direction of Arthur H. Blanchard, head of the Highway Engineering and Highway Transport Department of the University of Michigan, who is also president of the National Highway Traffic Association.

The speakers on the program have not as yet been announced, but it is his purpose to secure men of prominence in road development and in the development of road building machinery, equipment and materials. There will also be addresses upon various phases of construction and maintenance by heads of divisions of the Highway Department and county road officials closely identified with the state's good roads progress.

COURT RULING HALTS HIGHWAY OPERATIONS IN MINNESOTA

Right-of-way proceedings involving condemnations in advance of state highway improvements are suspended by order of Charles M. Babcock, highway commissioner, this week, pending a supreme court decision on a question of vital importance to Minnesota's good roads program. The lower court ruling upheld the contention of three property owners objecting to a state route in a new location for trunk highway No. 7 near Byron, between Rochester and Kasson. The highway department planned to build on the best engineering lines a cut-off to eliminate two dangerous grade crossings, an unnecessary turn and extra distance and also to continue serving the town of Byron, which unanimously endorsed the plan. The ruling, adverse to the state, threatened so much delay and confusion to the road program that Attorney General C. L. Hilton at once appealed to the supreme court. The case is already attracting wide attention throughout the state.

In an editorial on the importance of giving the highway department reasonable powers, The Minneapolis Journal states:

"It is to be hoped that the Supreme Court will see its way clear to taking the hobbles off the Highway Department, and giving it the chance to go ahead speedily with its great work for the benefit of the whole public. If this proves legally impossible, recourse to the Legislature must be had. Condemnation proceedings ought to be made quick and effective, so long as fair prices are paid for the land taken for public purposes, the State Highway Commissioner ought to have at least as much power over state roads as a township board has over town roads."

Highway officials said that there is a wide difference in the attitude of owners of property affected by road plans, a few demanding fancy prices but the majority seeing the benefits of a state road and asking only reasonable allowances, and some donating right-of-way to speed betterments.

WORK DELAYED ON IDEAL SECTION OF LINCOLN HIGHWAY

Progress in the construction of the Ideal Section of the Lincoln Highway has been materially delayed by the strike and resulting cessation of material shipments, is the announcement made from the headquarters of the Lincoln Highway Association.

This famous piece of road between Dyer and Schererville in Lake County, Indiana, the design and construction of which has probably received more thought and care than any other section of the road in the world, is being built by the Association to demonstrate what is believed to be the last word in modern, durable highway specifications for main routes of heavy travel. While the stretch is not long, being less than a mile and a half in length, it is being constructed with the utmost care and under the combined supervision of the Federal Government, the State of Indiana, and the Lincoln Highway Association. Every safeguard is being thrown around the work, to the end that the completed paving may be, in every respect, as perfect as modern highway engineering can produce. The work is therefore not being unduly rushed.

W. G. Thompson, Consulting Engineer for the Lincoln Highway Association and representing also its Technical Committee of highway engineers and other authorities, recently inspected the progress of the work, following the resumption of material shipments. Following a conference with C. Gray, State Highway Engineer of Indiana and Albert Scott, Vice-President of Lockwood, Greene & Company, engineers, in charge of the work for the Lincoln Highway Association, he announced that no chances will be taken in laying any of the concrete pavement during cold weather. This means that the pavement will probably be completed from the west end of the section to the bridg year, and the balance of the paving toward Schererville, be postponed until spring. The old macadam now extending west of Schererville will not be torn up, so that traffic will meet with a minimum of inconvenience during the winter.

BIG ROAD-BUILDING PROGRAM AHEAD

Fifteen to twenty years of building good roads lie ahead of the United States. Under the program which the country has adopted there will be built, during that time, 180,000 miles of improved highways, which will constitute the Federal-aid highway system, and an equal or greater mileage of state and local roads. When the great job is done, the transportation facilities of the country will far exceed those of any other nation, past or present, in the world. The highways of the ancient Romans, whose fame has come down through the centuries, will pale by comparison.

Details of this vast road-building program are to be placed before the Highway Education Board at its conference in Washington October 26 to 28, inclusive, by state highway engineers and officials of the U. S. Bureau of Public Roads, to whom has been entrusted the work of planning and supervising the construction of Federal-aid highways. The plan will be presented to enable the Board to proceed authoritatively with its work of devising aids for schools and colleges to which road-builders of the country are turning for competent highway engineers.

Officials of the bureau place the aggregate cost of the Federal-aid program alone at about $3,000,00,000, spread over the twenty-year period. They base this estimate on an average of $17,000 per mile. The average cost, in turn, takes into consideration all classes of improved roadways from the cheapest to the most expensive types. Approximately one-third of the proposed system, or 60,000 miles of improved highways, already are either built or building.

This program is a new one. Up to comparatively recent years, road-building in the United States had been conducted without special regard to a national system. Highways had been constructed where needed without considering whether they would link up in the most effective manner with the whole network of roads to be spread over the Nation. Engineers had sought more to meet immediate and local demands than the broader requirements of the States and Nation.

The present Federal-aid road-building program, officials of the bureau state, will contemplate the construction of only such roads as fit into the national program and contribute to the national system. At the same time the roads will be so selected as to serve the most important local requirements. With marked modifications, the system adopted in building the railways of the country will be borne in mind in the construction of the country's new highways. There will be main lines of highway communication between centers and thousands of miles of feeder roads, reaching back into the more sparsely settled regions and into the rich agricultural sections, to tap areas whose population and products will flow over the new system.

New roads will be planned and built—thousands of miles of them—where they will fit in most advantageously with the entire program. The bureau is continuing its research work into most efficient methods of roadbuilding, including the character and wearing power of materials, resisting qualities of varying subsoils, etc., and has amassed a considerable store of valuable information, all of which will be available for the highway engineer of to-morrow, whom the Board is seeking to have educated in practical and modern methods.

ROAD MATERIALS RESEARCH WORK EXTENDED AT PURDUE UNIVERSITY

An agreement between the U. S. Bureau of Public Roads and the Engineering Experiment Station of Purdue University has been reached, whereby the two shall co-operate in research work of value in connection with the building of public highways. The heads of the parties to agreement are Thos. H. MacDonals, Chief of the Bureau, and Dean A. A. Potter, director of the Purdue Engineering Experiment Station. The character of the investigations and research work, according to agreement, shall be conducted co-operatively under the direction of these two men.

In harmony with their agreement, the purpose of both parties is to secure and develop facts and information which will define the governing principles and advance the science of highway improvements, for immediate practical application to the expenditure of large sums of public money, now being made available for highway improvement purposes.

The investigation and research work will embrace three main projects, the total estimated cost of these plans amounting to $15,000. The government has assumed the responsibility of employing a proportionate share of necessary assistance for conducting such investigations as are agreed upon, and to furnish at its expense, special apparatus that may be required. The government has assigned two engineers to co-operate in the research work devoting their full time to it.

The first of the three projects is really a continuation of one now being conducted at Purdue University. It consists of the ball test of mortar and concrete. The total estimated cost of the project is $2,000, and the cost during the fiscal year, 1923, is $560. Three months is required for the completion of this scheme, it being in progress now. To finish the test, data is needed upon the following items:

1. New solid tire as compared to old solid tire now in use.
2. Pneumatic tire as compared to solid tire.
3. Different pressures in pneumatic tire upon the surface resistance to the ball test.
4. Recovery of strength after application of load through pneumatic tire.
5. Area of contact of pneumatic tire with slab, when tire is inflated at different pressures.

The second project, also in progress at present at the Purdue Engineering Experiment Station, takes up fatigue tests of mortar and concrete. The total estimated cost is $6,000 and the cost for the fiscal year of 1923 is $4,610. The estimated duration of the project is one year for completion. Following is the additional data which is needed::

A. To determine the critical load which may cause failure in a mortar and concrete beam by fatigue.

B. To determine effect of conditions which may affect the critical load as:

1. Rate of application of the fatiguing load.
2. Continuous fatiguing and alternate fatiguing and rest.
3. To what extent fatiguing is accomplished by heat.
4. Variation in the richness of the mix.

The third supplement to the agreement takes up static load tests of concrete road slabs. The estimated length of this project is one year and the total estimated cost is $7,000. The estimate of the cost during the fiscal year 1923, is $5,000. The purpose of this great project is to study the strength and distribution of stress in differently designed concrete road slabs. The general requirements of the procedure are as follows:

A. Size of slab, 18 ft. x 20 ft.

B. Design of slabs.

1. Rectangular cross-section.
2. Horizontal base but crown top.
3. Crown base and crown top but with sides thicker than center.

C. All slabs to have the same area of cross-section.

D. Slabs moulded on special supports.

E. All slabs loaded and tested in the same manner.

The Purdue Engineering Experiment Station will assume direction of the experiments as outlined; Dean Potter and Prof. R. B. Wiley, Head of the School of Civil Engineering, leading the work. However, designated representatives of the Bureau of Public Roads will have free access at all times to the tests, notes and results of the investigations. The Purdue Engineering Experiment Station will furnish all ordinary machinery and apparatus not otherwise specifically provided, and also all materials, light and power for making specimens and conducting tests in general, except in the case of large field specimens which will be covered by supplementary agreement.

Iowa has the greatest number of automobiles in proportion to its population, having a car for a little more than every five persons in the state. Alabama has the fewest machines in proportion to population, with only one car for each twenty-eight inhabitants.

Equipment — Trade — Materials

HAISS CREEPER WAGON LOADER

The Haiss Creeper Wagon Loader illustrated below is manufactured by the George Haiss Mfg. Co. of New York. This machine digs and loads into a measuring hopper of 15 ft. capacity, which in turn is discharged into a truck where it is conveyed to the concrete mixers. This method of handling material makes accurate measurement possible and there is a saving of 25 cents per yd. in the handling of the material.

Haiss Creeper Wagon Loader

The engines used in the creeper are of 37 hp. while the creepers are 8 ft. long and 10 ft. wide. These creepers are of cast steel links connected with high carbon steel pins and are self-cleaning. The weight of the loader is 13,000 lbs. It is equipped with the Haiss patented feeding propellers, which give a positive drive and do not depend upon the cohesion of the material to feed itself into the buckets. The loader is also equipped with a patented slow-speed worm gear which crowds the machine into the material simultaneously with the digging motion, and this action working in connection with the feeding propellers, thus forces a constant flow of material in front of the buckets.

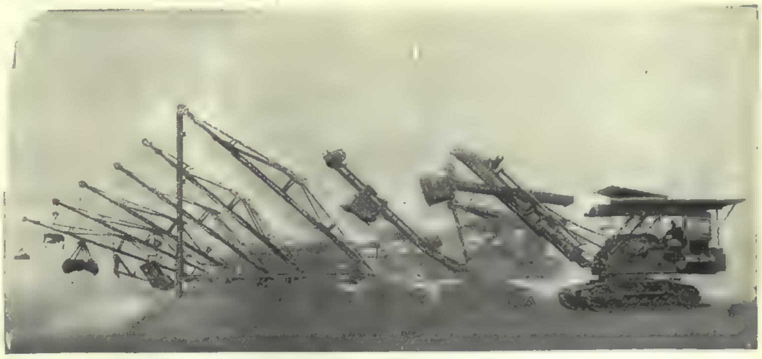
P. H. SUPER-TRACTOR CRANE

The larger contracting companies have long since realized the savings that can be effected by means of excavating and material handling machinery and they have invested large sums in this class of equipment. The smaller contractor, however, in time past was more backward about the adoption of modern material handling and excavating equipment because he sometimes felt that he had not enough work to justify the expenditure.

The Pawling & Harnischfeger Company of Milwaukee, Wisconsin, long ago sensed this need and have had upon the market for a number of years a machine which can be used for a wide variety of purposes, and which can therefore be advantageously used by small as well as large contractors. Briefly described, this machine is a super-tractor crane. It is of the all-steel, full circle type, driven by a powerful heavy duty gasoline motor, and is mounted on full corduroy traction or half corduroy traction, just as conditions demand. The traction is similar to that employed on army tanks and the tractive effort is so great that there is no hill too steep or mud too deep for the machine to negotiate.

A shovel attachment can be quickly mounted on this machine and the machine is then a powerful gas shovel capable of standing up under the severest work. The dipper sticks are of steel sheathed oak planks straddling the boom; the dipper racks are of manganese steel, and the shipper shift is a high carbon steel forging. The thrusting motion is accomplished by means of a set of planet gears connected by chain to the shipper shaft.

Equipped with a standard boom and a dragline or clamshell bucket, the 8 in 1 machine is used extensively for sewer excavation, pipe handling and backfilling. In especially hard soils an orange peel bucket is used. With a regular backfilling scraper this machine can easily backfill upwards of 2,000 yards of soil in an 8 hour day. The "8 in 1" machine can also be equipped with a skimmer scoop for tearing up roads, shallow grading, light cuts, and leveling off. The standard boom of the "8 in 1" machine can likewise be supplemented with a pile-driving rig which comes in very conveniently at times. Equipped with a standard crane boom, the possibilities of the "8 in 1" machine are without limit. Wire coils have bulky tanks as big as the machine itself or sugar cane can be handled with equal ease. The "8 in 1" is sometimes equipped with an electro magnet for handling pig iron, scrap, and any steel and iron materials. A special gooseneck boom has been used with this machine for handling package lumber in units of 2,000 board feet and up. With this device lumber can be stacked in places where there is not sufficient clearance for any other method of handling.



P. & H. Super-Tractor Crane

EVOLUTION OF WARRENITE BITULITHIC

(Concluded from Page 129)

of asphalt over the particles are much thicker than they are over the particles of sand in a sheet asphalt pavement. The asphalt is sufficient in quantity to fill the voids in the fine surfacing mixture under ultimate compression, while such is not the case in ordinary sheet asphalt pavement in which such a rich, flexible mortar could not be used to any appreciable thickness owing to its plasticity, but is very effective as a fine surfacing over a stable mixture into which it is blended and bonded into one integral mass. The flexible, rich surfacing mixture or mastic and the stable, coarse aggregate are blended together by compression, while both are hot and pliable, producing a structure with a maximum degree of resistance to displacement by the thrust of traffic throughout the body of the structure, and with a maximum ability to receive and absorb the shock and impact of traffic and thereby prevent the shattering of or damage to the structure below.

This construction was first laid in 1910 and the pavements were placed under observation under varying conditions of climate, subsoil and traffic. After several years' successful use, in which the utility of the new construction was demonstrated beyond question, specifications were adopted and issued by Warren Brothers Company to introduce the improved construction as the increased traffic demanded it.

Table 1, illustrates how the construction laid under the Warren laboratories and supervision has gradually changed during the past ten years to include the later construction above, until during 1921, over 85 per cent of the pavements laid were under specifications taking advantage of the development in the business. Table 1, also shows the general increasing recognition this construction has received from engineers and the public at large during the past ten years as further exemplified by the fact that over four million yards of the improved construction have been awarded and under construction during the first four months of this year.

TABLE I—DEVELOPMENT OF THE USE OF WARRENITE-BITULITHIC SINCE 1910.

Year Laid.	Area Using Flushcoat.	Area Using Fine Surfacing Mixture.	Total Both Kinds.	Percentage of total in which Fine Surfacing Mixture was Adopted under Official Specifications.
1910	3,046,402	874	3,047,276	0.3
1911	4,189,182	000	4,189,182	0.0
1912	4,801,900	28,701	4,830,601	0.6
1913	5,064,818	16,250	5,081,068	0.3
1914	4,122,646	82,297	4,204,943	1.9
1915	4,196,968	298,425	4,495,393	6.6
1916	4,700,109	819,656	5,519,765	14.8
1917	3,689,403	1,529,770	5,219,173	29.3
1918	3,267,087	1,532,696	4,799,783	31.9
1919	4,446,035	3,021,296	7,467,331	40.4
1920	5,017,512	6,242,135	11,259,647	55.2
1921	937,628	6,610,000	7,547,628	87.5
1922	(to May 8, inc.)	24,667,943	72,147,633	
Totals	47,479,690	24,667,943	72,147,633	

The development of the past twenty years has proved what was then claimed by its advocates—that a true, scientifically-prepared Asphaltic Concrete pavement surface, having high water-retardant, stable, wear-resisting properties, is, in the long run, the best type of pavement wearing surface for city streets and highways under most climatic and traffic conditions. Improvements have been made in that period and doubtless improvements will be made in the future. We can never expect to attain perfection in pavement construction—in fact, all things which are subject to the weakness of intellect and power of man will always lack absolute perfection. Pavements of all types are well included in this category.

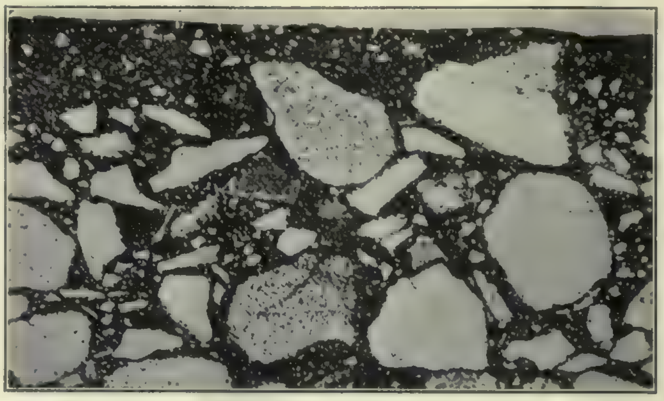


FIG. 11. CROSS SECTION OF FEDERAL AID PROJECT ON UTAH STATE HIGHWAY SHOWING BLENDING.

The shock-absorbing fine surfacinng mixture, super-imposed over the coarse, stable mixture, the two blended into one integral mass, densestat the top. Warrenite-Bitluthic wearing surface 1½ in. thick over asphaltic concrete base varying from 1½ in. to 4 in. depth in redressing macadam.

TREATMENT OF POSTS FOR GUARD RAILS

(Concluded from Page 131)

to the draining table where they will in a few minutes become dry enough to handle.

The equipment that I have described is capable of treating ten posts at a time and allowing five minutes for each charge to remove the treated posts and replace them with untreated posts, will treat 180 posts in 8 hrs.

So far, I have spoken only of that portion of the post from the ground line down. There are, however, portions of the exposed post where decay is likely to occur. Posts have their tops sawed at an angle and the top rail is fastened so that it rests on this sloping top. Whenever it rains moisture collects in the space between the top rail and the top of the post and is absorbed by the post. This surface being protected by the rail dries out very slowly and consequently the tops of the posts frequently decay. The same is true of the contact surface where the lower rails are nailed to the side of the post or within the holes through which cable is passed. Such contact surfaces and joints should receive protection. Personally I would sacrifice appearance and at least brush-treat all such surfaces. Another way would be to give the entire exposed portion of the post an open tank treatment just as the bottom was treated, using instead of the oil, a solution of sodium fluoride.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

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TABLE OF CONTENTS

Beautifying the Highways of Ontario 137
By Henry J. Moore

Cross Drain Construction on Concrete Roads . . . 138
By Louis L. Condert, Jr.

The Training of a Highway Engineer 139
By George S. Barry

EDITORIALS AND NEWS

The 1923 Good Roads Show 142
Connecticut to Make Traffic Survey 143
Nevada Plans Legislation to Curb Reckless Driving 143
Railroad Transportation Difficulties Hold Up Road Work in Pennsylvania 144
Traffic Court on Nevada Highways 143
Larger Crops Promote Road Usage 143

PERSONAL MENTION 144

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In the Valley are thriving towns, the largest of which are Mission, McAllen, Mercedes, and Harlingen. Here, too, the broad Tarvia-paved streets give unmistakable evidence of prosperity and sound, substantial growth.

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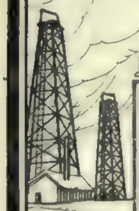

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GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE
WITH WHICH IS INCORPORATED
THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII OCTOBER 18, 1922 No. 16

Beautifying the Highways of Ontario

By HENRY J. MOORE
Forester Department of Public Highways, Ontario.

NO public work that is being done to-day can be of greater value in the development of a country than the building of good and beautiful roads. Whether roads of a province or state they are links in a national chain and the prosperity of the nation will depend very largely indeed on the condition of its roads.

Good roads are necessary that people may live, in that they may be able to market necessities which others may require or in order that necessities which they themselves require may be transported quickly and at a reasonable cost. Good roads reduce haulage costs, make property through which they run more valuable, encourage the practice of agriculture and the development of ricultaral resources. They attract tourists and stim-ate immigratiion. They advertise a country as nothing else can. They attract factories with their various in-ustries, the automobile industry and others and so are e means of making the wheels of commerce turn as ell as those of pleasure.

Good Roads the Basis of Prosperity

To-day the paved road is coming into its own. The sis of commerce and industry lies in transportation by ruck. The people take their pleasure largely by motor. Good roads are therefore essential. Would it be too great a stretch of imagination to say that the mileage of good roads in a country in proportion to the number f people living therein is a criterion of its prosperity? Countries without good roads are never prosperous. Cities with paved streets in such countries may in themselves be prosperous the country never, for the potentiality of its resources cannot be fully released. The wheels f the grist mill will not turn all the time, the grain has not been grown. That which should be first alas as been left to the last, the paved roads still remain a dream.

What of beautiful roads? Once upon a time we thought that trees, shrubs and flowers costing as they did a little money were luxuries. Beauty a luxury? These wonderful things were made to clothe the earth and to soften the harsh places. To beautify that which is ugly. To attract and arrest the attention of the careless and to turn their thoughts to better things. To inspire; inspiration creates ideals, gives us better thoughts. Environment is one of the influences which mould our character individual and national, for as individuals are influenced so are nations.

Are our roads forever to be but a means of money making affording a quick means of transit for goods, and for business men in high-powered automobiles or is there also to be a moral as well as an economic side to the question? The moral factor in the lives of nations is the factor which alone can safely guide their destinies. Will not millions of the best people use the good roads that are now being built? Will they not use them for pleasure? If so, then surely such roads ought to be beautified. There is nothing beautiful or inspiring along roads where the hot sun pours down and where there are no trees to shade from the torrid heat or greenery to rest the eye from the eternal glare. Not much pleasure to be obtained motoring along such roads.

What Canada Is Doing To Beautify Its Roads

The Government of the Province of Ontario has decided to beautify the Provincial Highways. The total mileage of these is at present approximately 2000, but this does not include other roads of which there are thousands of miles. It is the aim of the Department of Highways to make the forementioned 2000 miles of road 86 ft. in width, as it has been found that the ordinary 66 ft. width it too narrow for modern demands, as not only should the right of way be wide enough to accomdate the roadway and ditches, but also the main trunk lines of the telephone and electric power and light, and last but not least to provide a planting space for trees and shrubs, and one which in course of time may be neatly boulevarded and made pleasing from an ornamental standpoint. About 500 miles have been so widened or are in process of widening and the cross section shows 30 ft. for roadway and 8 ft. for ditches on each side and 20 ft. for poles (where necessary) and trees on each side. On such highways there is little danger of trees interfering with the telephone and power service and so harmony from the useful as well as from the aesthetic standpoint must exist.

About every 100 miles of highway constitutes a residency and is under the control of a resident engineer; such engineers have under their control a number of foreman and their gangs of men. During fall and spring when the road work is not in progress these foremen and gangs carry out the planting of trees and shrubs. The trees are largely selected from the bush lands adjacent to the highways and being native are thus desirable for the purpose. Twenty-five cents per tree is paid to the farmers, and the work of hauling and lifting is paid for by the department. The total cost of lifting, planting, staking and mulching is less than $1.25 per tree. In cases where especially fine well shaped and rare specimens such as oaks are required the cost is a little more. Recourse is also made to the nurseries for some trees and shrubs.

In purely country localities native trees are alone planted, as it is the desire of the department to keep the highways typically Canadian, such trees as the red and white oaks, hard or sugar maple, elms, white ash, black walnut, butternut, native chestnut, basswood, and so on, are utilized. At the approach to the various municipalities exotic trees are also included and comprise Norway maples, oriental planes, and other shade trees of recognised value.

The minimum spacing of trees is 75 ft. in the rows which are located two feet from the fence lines. With such spacing every tree has a chance of perfect development and as light and air have free access to the roadway, moisture does not remain thereon for any length of time to cause disintegration of the surface.

Wherever at intersections of the highways near towns small waste areas exist; these are beautified by trees and shrubs. Two such parks have already been laid out, one at Port Hope, and another at Cobourg, and where at the approaches to large municipalities special treatment is desired this is effected with the co-operation of the municipal authorities, special grading of areas, and the planting of shrubs is effected by the Department of Public Highways and are maintained at the expense of the municipality. The easterly approach to the city of St. Cathatines, which passes the beautiful and well kept Victoria Lawn Cemetery, is shortly to be beautified in this way.

No injury to permanent plantations, or to existing trees is permitted a penalty provided by law is inflicted in the case of wilful damage or of vandalism. No company or person may without permission cut or remove a single branch. Needless to say that in the case of existing wires or cables any necessary and reasonable cutting is allowed but only under the direction of an expert on the Provincial Highways of Ontario. The straying of cattle along the highway is also by law prohibited. However, generally, the law has so well been observed that no prosecutions have, up to the present been necessary.

Not the least important of the work carried out by the Ontario Department of Highways is the reforestation of abandoned gravel pits and quarry areas. These wherever possible are reforested with seedling pines, or with other commercial trees. Steep banks where considerable cutting or filling has been done by the engineers to reduce the grades are also landscaped or reforested as the case may be. As many of these areas are contiguous with the highway the educational value of the project will readily be understood. Motorists may readily see the planted areas without even leaving their cars. The Ontario Department of Forestry very kindly supplies the seedling pines from its nurseries.

Ontario desires not only to beautify her highways but also to assist residents living along them to beautify their property so that not only will the planting strip be beautified but the frontages of farm and suburban homes, school grounds and cemeteries. For this reason a plan will be supplied to all persons whom having a real desire to improve their property will undertake the work Many such plans have been prepared. Where such improvement is affected, the increased value of the property more than justifies the expense. One good turn deserves another and it has been extremely gratifying to find that in turn people have actually offered to undertake the maintenance of the highway planting strip outside of their fence line.

(Concluded on Page 144)

Cross Drain Construction on Concrete Roads

By LOUIS L. COUDERT, Jr.

THE usual practice in the construction of cross drains has been to construct the drains before the concrete road was placed, and then make the concrete road meet the drain. There are several weak points in this method. First, it makes no difference how careful the engineer is in laying ou tthe culvert, it usually turns out a little too high or a little too low. A quarter of an inch difference in elevation between the road and the cross drain is apparent when riding over it. Second, when the construction is such that the cross drain is supposed to conform to the crown of the road, it is almost impossible to get the same crown on both the pavement and cross drain, as the template used for bringing the roadway to its proper crown is about the last thing to be brought on the job. When the job is stretched out over two or three miles, and several cross drains are under construction at one time everybody wants the template at the same time. Third, by constructing the cross drain before the pavement is laid, it is necessary to put in a joint on each side of the cross drain. These joints placed a few feet apart do not improve the appearance of the pavement nor do they tend to make the riding any smoother.

To eliminate these undesirable features the following method has proved successful on small cross drains.

(Concluded on page 144)

The Training of a Highway Engineer

An Overseas View of an Important Topic

By GEORGE S. BARRY

Surveyor of the Ayr District of Ayrshire

THE profession of a highway engineer, or road surveyor as it is termed in Scotland, has to-day attained a degree of importance which it never before held. This is primarily due to the remarkable development within recent years of mechanical transport and the consequent application of newer and better methods of road making and maintenance. Such a development suggests a corresponding development in the administrative and technical aspects of the profession. These newer methods have enlarged the experience of highway engineers just as the introduction of the turbine and the Diesel engine did in the case of mechanical engineers.

In by-past years, the vocation of a highway engineer was largely recruited from trades and professions which had only a partial connection with highways. The regularly trained engineer was not very much in demand, mainly because many local authorities did not appreciate the value of a trained man, and seemed to prefer the services of one who invariably had to learn or "grow into" the work.

Highway Engineering

To-day such a condition is unthinkable, and it is now appreciated that a public body pays an official to do his work instead of being taught how to do it. When it is considered how much is embraced by the term "highway engineering," it will be conceded that this occupation now forms a definite and important branch of the broader term "civil engineering." The enormous importance of highway maintenance has brought with it the demand for a specialised knowledge and training as is evidenced by the requirements of the more important local authorities on the one hand and the Ministry of Transport on the other, the latter body having quite recently refused to recognise certain road appointments made by local authorities.

It is becoming more and more evident that the education of a highway engineer must be placed upon a proper basis. So marked has been the development in road-making and upkeep that it now becomes necessary to consider what can best be done in this direction. For example, up till about fifteen to twenty years ago it was not essential that a highway engineer should have any knowledge of the principles of chemistry, but to-day this branch of science takes such a prominent place in his daily work that some knowledge of the chemical constituents of the various materials he employs and the laboratory tests which are required to determine the most suitable materials for his purpose, is essential. The chemical aspect is but one thing. There are others which also demand the greatest consideration, namely, geology and petrology, the strength of materials and the theory of structures, to mention only a few, all of which have been more or less neglected in the past so far as highway engineers have been concerned.

Theoretical Education

Almost any technical college of prominence offers a sufficient array of subjects for the youth training as a highway engineer, but some little guidance as to suitable subjects may not be out of place. The author, therefore, suggests the following subjects as providing a suitable course of study for those who are to undertake later on the duties of a highway engineer.

The course might include:—

Geometrical Drawing.
Plane and Solid Geometry.
Building Construction.
Machine Construction.
Mathematics, including Trigonometry.
Applied Mechanics, including Graphic Statics.
Theory of Structures.
Strength of Materials.
Engineering Chemistry.
Geology.
Geodesy.
Sanitary Science.

About half of these subjects may be taken at a good average technical school, and the student should make the most of his time by gaining a thorough grounding in them. By this means he will be better prepared to take up the more specialised subjects which he can study later. It is important that he should not take up too many subjects at one time, but spread them over a few years. An essential preliminary to any course of technical instruction is a good sound education, and it is assumed that, before taking up his training, an apprentice or pupil to a highway engineer has reached a standard of general education necessary and fitting for his professional career.

Examination Tests and the Preparation for Them

There are many capable engineers who regard a professional examination as an unnecessary thing which affords no real test of a candidate's ability. There was something to be said for this point of view when examinations were almost entirely of a theoretical or academic nature, but within recent years there has been

Abstract of a paper presented at the Annual Meeting of the Institution of Municipal and County Engineers, July, 1922.

a considerable infusion of really practical detail into some examinations, and this has greatly enhanced their value. Up to seven or eight years ago no exclusive examination existed which formed a test of a highway engineer's training and experience. The Institution, recognising the need for such a thing, introduced the examination for the Certificate in County and Highway Engineering. The requirements of this examination are, perhaps, struck more from the English than from the Scottish standpoint, but there is no doubt whatever that it is at once the most suitable and at the same time the most specialised test in this country so far as road engineers are concerned. The author would, therefore, suggest that more prominence be given to this examination, and that every inducement should be extended to pupils and assistants who are anxious to secure reliable evidence of their technical and practical attainments in highway engineering.

The Question of Tuition

The question of tuition naturally asserts itself, and herein lies a difficulty so far as most road surveyors' pupils and assistants are concerned. In most cases the highways office is so situated as to be out of reach of a technical college or other institution affording a suitable technical education, and candidates are obliged to take up what is sometimes a rather doubtful method, namely, correspondence tuition. Now, there are several sound firms who take up this method of coaching for examinations, but before a student engages in such a course he should satisfy himself that the tuition offered is thoroughly up-to-date, that it covers amply the requirements of the examination, and that the tutors are persons of proved ability.

This form of tuition, convenient though it is, is largely dependent upon the student and how he tackles his work of preparation. A system which has been adopted with much success of late in other spheres is that of the summer school. The method consists of holding at one or more suitable places during the summer months a series of lectures and demonstrations by prominent persons. These gatherings generally extend from a week-end to a whole week, and sometimes longer, and provide the means of bringing students and others into touch with persons who are recognised authorities in their particular branch of learning. Accommodation is generally provided at a moderate rate, while other facilities are also kept in mind. The author does not think that it would be a difficult matter to introduce such a method which would be of so much benefit, particularly to the younger members of the profession. The success of the scheme would, however, be dependent upon the amount of interest taken by the profession as a whole.

The proposal has been put forward of creating a chair of highway engineering in one or more of our universities. It is a thoroughly good one, but is, perhaps, not possible of general adoption at he present time. There is another method, however, which ought to be developed more than it is, namely, the formation in our universities of honorary professorships. It involves the appointment of a practising engineer who is an expert in his particular branch of engineering, and the method therefore provides that practical touch which is so essential in the case of a university engineering education. By it students would be brought into frequent touch with professional men who are day after day carrying out in practice the best methods of road maintenance and all matters connected therewith.

As another aid towards increasing the efficiency of the profession, the clearing house idea might be considered. There is such a variety of experience gone through in all parts of the country appertaining to road matters that it seems strange that no definite attempt has so far been made to collate the information obtained, thereafter making it available for the use of all members of the profession. Certain associations have done much good work in this direction, but their efforts have been somewhat restricted owing to their being voluntarily supported. The application of the clearing house idea to road matters is deserving of the most earnest consideration. Perhaps this could be realised by the establishment under the Ministry of Transport Roads Department of a bureau of road information maintained out of taxation. Information gathered from all parts of the country could be critically examined by a staff of skilled engineers, tabulated and made up into useful reports dealing with all matters connected with road making and maintenance. The possibilities of such a method are obvious, and the diffusion of the information obtained could not fail to be of immense practical value to all who are engaged in making and maintaining the country's highways.

Practical Training

Important though the office work of a highways department is, it cannot be regarded as of equal importance to the outdoor work. The keeping of records, the preparation of plans and estimates and other office work, although affording valuable experience, are of little consequence in themselves, and must necessarily be supplemented by a systematic outdoor experience.

What is of outstanding importance to a highway engineer is the need for him to become thoroughly familiar with the road system of his district, the subsoil, the nature and sources of the available road stones, and the most suitable methods of copying with road wastage. In this connection stress may be laid upon the working of quarries.

In some districts the supply of suitable road material is a serious question, and much attention must be paid to the utilisation of that local materials exist. The opening up of quarries and their development along proper lines are matters of paramount importance. Again, where an extensive plant is utilised, the greatest care has to be observed with regard to its arrangement so as to permit of economical and expeditious working. Much can be learned by a young engineer by frequent visits to the quarries. He should make himself familiar with every detail connected with the production of metal by studying the methods of quarrying, drilling and blasting, and the mechanical principles of stone-breaking plant. The same might be said of all other machinery employed in connection with highway work, such as steam and petrol rollers, tractors, tar macadam mixing plant, and so on. He may not possess the advantages of a training in mechanical engineering, but he can at least make use of every opportunity for studying all kinds of road plant sufficiently well to be able to discuss its arrangement, use and repair with the men in charge in an intelligent manner.

His attention should also be directed to the organization of workmen and the execution of work generally, in such a way as to produce the maximum of efficiency with the minimum of plant and labor.

In the matter of surveying it should be borne in mind that a mere book knowledge of the subject is quite inadequate. What is essential is frequent practice in the field, and perhaps the best form of this is the setting out or location of works. Generally speaking, it may be said that one who is able to set out accurately a job of fair size can execute a survey without difficulty. Moreover, it is highly desirable that the records of a survey be entered with sufficient care and clarity so that no difficulty in plotting them may be experienced even by another member of the staff than the actual surveyor. Convenient although ordnance maps are, they should not be used when a larger scale plan is really necessary.

General Requirements

To tabulate the main points to be aimed at in a highway engineer's training, the author puts forward the following:

1. A sound practical knowledge of surveying and levelling, the principles and care of instruments and the ability to make and check observations, and the accurate plotting of same.
2. Ample practice in draughtsmanship and the proper use and care of drawing and computing instruments.
3. A good all-round knowledge of the various materials used in road making and maintenance, the tests applied to same and the methods of using.
4. A sound knowledge of the different kinds of plants used in connection with the production and transport of materials and the making and maintaining of roads. Ability to know exactly the type of plant to employ economically upon a particular class of work.
5. A thorough knowledge of the methods of costing and general office routine.
6. Ability to take out quantities, draw up specifications, prepare estimates of probable cost, as well as the making of inspections and the writing of reports.
7. A satisfactory knowledge of the designing of bridges, culverts, retaining walls, etc., and the calculations involved therein.
8. A complete grounding in the legal aspects of the profession—that is, a knowledge of the various Acts of Parliament and Orders applicable to roads and transport, in addition to the court decisions on important highway cases.
9. Ample practice in the detailing and organizing of labor and plant engaged upon all branches of highway work.
10. Sufficient knowledge of architectural design to enable him to execute the plans appertaining to roadmen's cottages, central depot and stores, etc.
11. The making use of every opportunity of broadening his knowledge by occasional visits to works in progress outside his own area, and generally keeping in touch with all the latest and most up-to-date methods.

Such a paper as this would hardly be complete without some reference to the keeping of a dairy. The author is afraid that the practice is not very general, yet the value of it is so great that it ought to be one of the first considerations of a surveyor. Notes and observations upon the condition of roads, dispisition of plant, weather, quarries, labor, etc., set down at the end of each day are bound to form a record of immense value, especially as an aid to the preparation of annual, quarterly and other reports.

A mere theoretical training is not enough in itself, but it forms a ground work or foundation upon which a sound practical experience may be built. The haphazard and incomplete methods of training which have in the past pertained to such a large extent will not do. The profession of a highway engineer is now of such vital importance that some definite standard must be adopted. The author has, therefore, in these notes this standard may be followed and attained. In many respects the present is but a transition stage in highway engineering. The country's ways of communication, much neglected during the late war, are now emerging from the conditions which contributed to their wastage, and are admittedly showing gradual improvement. Among the factors which will in the future contribute to the production and maintenance of a thoroughly up-to-date road service serving adequately the needs of the people, none is of greater importance than a well-trained and efficient highway engineer.

Seasonal limitations on gross weight of motor vehicles are provided for in an amendment, effective Sept. 12, to the motor vehicle law of Massachusetts which permits a maximum gross weight of 14 tons and 800 lb. per inch width of tire. The amendment grants to the State Department of Public Works authority to rule off the road at any season of the year vehicles having gross weights exceeding 19,000 lb., if in the opinion of the department they would cause serious injury to the highway.

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CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE 1923 GOOD ROADS SHOW

With the early start that was made during the summer through a partial reorganization and an election of officers in the American Road Builders' Association and the creation of the Highway Industries Exhibitors' Associaion to bring about closer cooperation, arrangements are rapidly being perfected for the Thirteenth American Good Roads Congress and Fourteenth National Good Roads Show to be held in Chicago, January 15, 16, 17, 18 and 19, 1923.

The early beginning has enabled those in charge to perfect a working organization so harmonious and effective that conditions nearly 100 per cent perfect are assured for the next big double event. While many of the most important features of both congress and show will be retained others both new and novel will be added.

It is the intentiion to separate the congress and show, by holding the former at the Congress Hotel and the latter as usual at the Coliseum. It is believed this arrangement will be more satisfactory as it will obviate the necessity of shutting down the operating machinery during the sessions and will eliminate the noise that has proved so annoying to speakers and delegates at the convention. The new arrangement is also expected to increase the attendance at each session of the congress.

Shortly after his election, Thomas J. Wasser, president of the American Road Builders' Association for 1922-1923, appointed to the Executive Committee the following: Charles M. Upham, state highway engineer for North Carolina; James H. MacDonald, consulting highway engineer, New Haven, Conn., and J. H. Cranford of the Cranford Paving Company, Washington, D. C. By reason of his position as secretary E. L. Powers became ex-officio a member of the committee.

This committee, acting for the American Road Builders, Association, appointed Messrs. Upham and MacDonald, and the Highway Industries Exhibitors' Association designated its president, S. F. Beatty, vice-president of the Austin-Western Road Machinery Company of Chicago, to act as a committee having general charge of the arrangements for both the show and the congress. The committee is known as the Convention and Show Committee.

This committee has now created several sub-committees to have charge of the various detailed arrangements as follows: Transportation Committee, Royal M. Allen, chairman; General Publicity Committee, S. T. Henry, chairman; Chicago Press Committee, W. R. Harris, chairman; Exhibitors' Committee, C. R. Ege, chairman; Entertainment Committee, A. C. Cronkrite, chairman; Reception and Hotel Committee, John B. Hittell, chairman; Registration Committee, L. S. Louer, chairman; Banquet Committee, Joseph R. Draney, chairman; Program Committee, E. J. Mehren, chairman.

The Exhibitors' Committee has employed a professional director of exhibits in C. W. Kelley of Chicago, who, though never before identified with the road show has managed some of the biggest expositions in the country, and the Publicity Committee has re-engaged C. S. Lee of New York, who handled the publicity work for the shows and conventions iin 1921 and 1922.

According to Chairman Upham of the Convention and Show Committee the chief difficulty will be encountered in providing space for all the exhibits, though arrangements will be made for all the additional space it is possible to obtain. "The Highway Industries Exhibitors Association." said Mr. Upham " is giving us splendid co-operation in working out the arrangements. We expect to conduct a publicity campaign of greater compelling force and more far-reaching effect than ever before and I believe the attendance will break all records.

"The program for the Congress as it is being worked out by the Program Committee, will be the exact reversal of our previous ones. Instead of avoiding controversial subjects as in the past the program next year will be made up almost entirely of controversial subjects of interest to the road-building industry as a whole. This, we believe will greatly increase the interest in the program and will provoke highly interesting and instructive oral discussions from the floor."

The American Road Builders' Association has opened new offices at 37 West Thirty-ninth St., New York City, Headquarters will also be opened in Chicago long in advance of the congress and show.

Two distinct types of motor drivers are the reckless one and the careless ones. The former should be pursued relentlessly, given punishment commensurate with his offense, and denied fellowship with other motorists. The careful driver should receive the strongest commendation. The reckless driver has no care for the other fellow or for himself. He is afflicted with a species of mania. His kind must be outlawed.—*National Motorist Association.*

CONNECTICUT TO MAKE TRAFFIC SURVEY

Under a co-operative agreement the U. S. Bureau of Public Roads and the Connecticut State Highway Department have undertaken the most comprehensive survey of highway traffic ever attempted. The survey is of an intensive character and will continue for a period of 12 months so that the seasonal variations in traffic may be studied and recorded. The principal purposes of the survey are as follows:

To determine the total traffic density type of traffic, and seasonal, daily and hourly variations; gross truck-loads, net commodity loads and overloads;; the net tonnage movement and character of freight by motor-truck, and average length of haul of motor-truck shipments, with regard to commodities, capacities, and production areas; and the relation of motor transport to other methods of transportation.

NEVADA PLANS LEGISLATION TO CURB RECKLESS DRIVING

The State Highway Department of Nevada is engaged in gathering data which it will be prepared to place before the next session of the Nevada legislature, for the purpose of obtaining the passage of uniform laws prohibiting reckless driving. This pertinent step, according to Geoge W. Borden, state highway engineer, presages enactment in the not so far distant future, he hopes, of uniform traffic regulations for the entire state. His view is that such uniform regulations already are a necessity.

RAILROAD TRANSPORTATION DIFFICULTIES HOLD UP ROAD WORK IN PENNSYLVANIA

Grave concern is felt at the Pennsylvania State Highway Department over the situation now confronting it on account of transportation difficulties which will make it impossible to complete roadways now in course of construction during the present season unless some relief is afforded. Assistant State Highway Commissioner George H. Biles characterizes the situation as "very accute."

On only two-thirds of the 160 contracts now in force was paving work carried on the past week.

He states reports received at the main office to-day indicate that contractors on over half of the program are about to the point of exhaustion in the supply of materials.

"One week ago there was only sufficient material stored on these contracts to take care of about twenty-two miles of pavement. When it is considered that this is distributed among a large number of contractors, it will be but a few days until they will be entirely out of material resources and unable to lay pavement.

"Everything is being done to alleviate the situation but under these abnormal conditions efforts are apparently of no avail. If there is no early change for the better, sections of highways on our main thoroughfares, in which are included many borough streets now under construction, will be in practically an impassable condition during the winter months."

TRAFFIC COUNT ON NEVADA STATE HIGHWAYS

The Nevada State Highways Department has just completed a series of traffic counts on various improved sections of the state highway system in several counties which show what may be expected in traffic increase on the roads after they have been improved.

The first traffic count was made on the Reno-Carson road at the junction of the Moana Springs road, and was taken in September, 1917. No part of the road had been improved at that time and seven days' traffic totalled 3038 vehicles of all classes. In September, 1920, after the road had been paved, the count jumped to 5141 for seven days, an increase of 69 per cent.; in September, 1921, to 7025; and in September, 1922, to 8887, the 1922 total being an increase of 193 per cent. over 1917.

Another surprising fact brought out by this traffic census is the relatively small percentage of cars from other states. This will serve to explode one of the popular theories that the transcontinental tourist is the all-important and heaviest user of our highways. The number and size of the trucks passing the point of census also presents some very interesting data, especially on the number of trucks classed as 5-ton or over. Many of these trucks were carrying double the rated load of the truck, and it is this class of vehicle that will rapidly destroy the highways unless adequate legislation for the curbing of overloading is passed in this State.

The count also shows that sections of the state highway system near the towns, and which may be classed as farm-to-market roads, as indicated by the traffic record, are the sections of importance, and should receive first consideration whenever possible.

BEAUTIFYING THE HIGHWAYS OF ONTARIO

(Concluded from Page 138)

Not the least important of the activities of the Ontario Department of Public Highways is the giving of advice to country roads engineers and superintendents, and also to municipal councils, in the matter of selection of trees, pruning, planting and other matters pertaining to tree culture. Upon request lectures are given during the winter evenings in nearly all parts of the Province on highway beautification, landscape art and allied subjects. In these the Highways Department and the Department of Agriculture co-operate as far as compatible without the duties of one overlapping the other. It will readily be seen that any work which pertains to the beautification of the highways and farm frontages must necessarily be of interest to the Department of Agriculture and so, through the Horticultural Branch of the latter, splendid co-operation is affected.

Beautifying the Bridges

Some of the new bridges constructed or under construction span ravines which are 900 to 1000 ft. wide. These bridges are largely of steel and concrete and of ornamental design, light and graceful, but sufficiently strong and rigid to carry all loads that the Department allows upon the highways. One has but to compare them with the bridges lower in the ravines which previously gave service, to realize the tremendous advance that has been made in the construction of highway bridges. Bridges are permanent features and as such should be beautiful in design. When so they serve a great educational purpose and are objects to admire. Ontario is building such bridges.

Beautification is the high water mark of civilization. Beautiful highways, buildings and home surroundings. The good and beautiful roads of the Province of Ontario will stand as a milestone in the advance of civilization. Beauty along the way is an asset, the value of which the human mind cannot compute.

All roads lead to Canada, Ontario is the most populous province, it will have perhaps the greatest mileage of improved and permanent highways. Ten or fifteen years hence the trees along these will have so developed as to produce an asset of beauty and of usefulness that millions of dollars could not buy. If as men and governments come an go and if they in their wisdom continue the policy of beautification and of reforestation the high? ways of Ontario will be very impressive, dignified and beautiful. Surely along these highways the tourist will find peasure and the native born? well, to him they will be an heritage.

CROSS DRAIN CONSTRUCTION ON CONCRETE ROADS

(Concluded from page 138)

Construct the bottom and side of the proposed cross drain leaving the top off where the pavement crosses it. The top of the sides of the cross drain are brought to the elevation of the sub-grade. Two inch planks placed on braces of 2 by 4s on 2 ft. centers, so that the planks are level with the top of the drain. Over the planks is placed a layer of tar paper to prevent the concrete from leaking through.

This permits the pavement to be cast over the cross drain in a monolithic slab, eliminating any differences in elevation, a difference in the crown and two construction joints. Extra reinforcement is usually placed over the drain, making two layers of wire mesh or reinforcing bars at this point.

After the concrete pavement is set, an iron bar a little over half the width of the pavement in length with a hook on it will dislodge the 2 by 4 braces holding up the 2 in. planks. The planks can then be removed very easily.

In order to eliminate the possibility of cracks, the bottom and sides of the cross drain should be laid at least 21 days before the pavement is put on it, as to allow times for shrinkage and settlement of the cross drain.

Where iron plates are used the same general method can be pursued as in a reinforced concrete cross drain, except only the bottom is put in. The forms for the sides are then placed and the plates put on the top of the form. Concrete is then grouted around the plates giving the plates a firmer bearing than it can possibly hope to get when the entire form is cast and plates fitted afterwards.

LARGER CROPS PROMOTE ROAD USAGE

Bumper crops, amounting in value to $1,250,000,000 more than last year, according to predictions made by the Department of Agriculture, are not only expected to mean a wider support among farmers for highway building programs, but a greater use of the highways for business and recreation purposes. The department's estimate is that this year's important crop will aggregate approximately $6,600,000,000. Present indications are that most of the crops will be worth more than last year, the exceptions being wheat, rye and peanuts, while corn, cotton and hay will be away up.

PERSONAL MENTION

J. M. Felhnor has been selected by the supervisors of Colusa county, Calif., to supervise the construction of approximately 50 miles of highway.

E. R. Neff has severed his connection with the city of Jacksonville, Fla., where he was employed as assistant city engineer, to become county engineer of Bradford county, Fla.

J. G. Morgan has been appointed by the State Highway Department to be bridge engineer for Palo Pinto county, Tex.

H. S. Hinrichs, formerly instructor in charge of the Tractor and Auto School, Northwest School and Station, University of Minnesota, Crookston, Minn., is now connected with the service division of The Holt Manufacturing Company, Peoria, Illinois.

Abel Wolman has been elected chief engineer of the Maryland State Department of Health, to succeed Robert B. Morse, resigned. Mr. Wolman will continue his activities as lecturer in sanitary engineering in the JJohns Hopkins University School of Hygiene and Public Health and as editor of the Journal of the American Water Works Association.

A. W. Graham, formerly state highway engineer of Missouri, A. T. Brown, formerly with the Highway Culvert Co., St. Louis, Mo., and F. J. Beard, formerly engineer of surveys and plans of the Missouri State Highway Department, have formed the Highway Equipment & Material Co., Jefferson City, Mo. The new organization will deal in highway equipment and supplies.

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TABLE OF CONTENTS

Federal Aid for State Highways 145
By C. N. Bass
Repaving the Washington Boulevard of Chicago . . 146
By John B. Hittell
Traffic and Transportation Regulations 147
Tentative Recommendations Presented by a Committee of the American Society for Municipal Improvement
Testing for Better Skew-Arch Bridges 149
Concrete Road Construction 149

EDITORIALS AND NEWS

A Year's Development 150
Highway Conference to Consider Training of Men to Administer Public Funds 150
Fall Letting of Road Contracts Now Favored by 17 States 151
Manufacturers Hold Conference to Consider Mutual Problems 151
Reciprocity in the Practice of Professional Engineering 152
Movement of Highway Materials Improving . . 152
Paving Patent Upheld 152

EQUIPMENT-TRADE-MATERIALS

Macleod Asphalt Surface Heater 153
A Time Study of Curb Construction 153

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CONSTRUCTION TRANSPORTATION MAINTENANCE
WITH WHICH IS INCORPORATED
THE HIGHWAY CONTRACTOR AND ROAD BUILDER
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Federal Aid for State Highways

The Problem of Coordinating State and Federal Effect

By C. N. BASS

Assistant Chief Engineer, Tennessee State Highway Department

AT the outset of the Federal Aid plan, which may be taken practically as 1916, less than 40 per cent of the states of the Union had functioning highway departments. It was therefore, a tremendous task for the Federal bureau of roads to get under way the many activities involved in aiding the states in the construction of highways.

It is possible to comprehend something of the physical and financial undertaking for the building of a large bridge or a great building, because each may be encompassed within the range of vision, but who can picture to himself adequately the immensity of the highway improvement demands which were and are now being made in the United States, to say nothing of its territorial possessions. No other nation has ever undertaken to supply adequate transportation facilities to an area of over 3,000,000 square miles, Germany has 208,780 square miles, while the boarders of Texas alone encloses 262,398 square miles, and even Tennessee, a much smaller state, has 41,687 square miles. Our states are empires in their extent and the whole future of this nation will be largely modified and determined by the factor of transportation, including in this sense all forms of interchange· What is true of the nation is true of the individual.

Determining Policies for Federal Aid

It would seem, therefore, that the following general statements were properly given full weight in determining policies for Federal Aid. First, there were no precedents from which we might accurately estimate the total cost of providing the necessary improved highways, but the financial aspects even now are so large as to demand the most careful and scientific policies which could be determined. As the costs accumulate from year to year the increasing demands upon the financial foundation will cause failure unless these nation-wide policies are properly determined and planned for the future.

Second, no reason can be offered not to plan well for the future, for we are yet near the beginning of highway building in its major sense. There are not the same uncertainties that confronted the railroad builders. The early railroads were built largely on the strength of prospective, and to an extent, problematic, traffic. The highways are being built for traffic already waiting, and, as is generally felt, impatiently waiting.

Third, there are plenty of evidences that the taxpaying public is rapidly nearing the end of its ability, or at least its willingness, to act further in the capacity of a shock absorber. Too many public enterprises have been saved from bankruptcy only by calling upon the public treasuries for additional funds to wipe out the deficit between estimate and cost, between income and expenditure. There is no reason why the highways should not be placed in the self-supporting class. They are not a luxury nor an incidental but are one of the indispensable facilities to the life of the nation and of the individual The highways are possessed of a real earning capacity and this must be recognized, collected, and credited to them.

Earning Power of the Highways

There is difficulty in properly allocating the earnings of a highway between the different and various services which it performs· This must be accomplished by a fair and impartial study and investigation. All the aspects of highway improvement are so modified by the particular and specific conditions of the locality, small or large, under consideration, that he who is wise will not make either general or dogmatic rules or assertions, predicated on insufficient or circumstantial data. Many of the assertions considered to be almost axiomatic fall down as soon as examined in the light of real fact.

The long accepted theory that "highway bonds must be issued for a shorter period than the life of the road," comes under this class. Many roads built years ago are better today than when they were built. The term "permanent roads," however, is a fallacy which is responsible for more or less of the unsound theory with reference to the issuance of road bonds. There are certain of the essential road constructions which may be

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Abstracted from *Tennessee Highways* for October, 1921.

considered in the true sense of the word, permanent, such as the road bed and drainage structures. Road surfaces of whatever type deteriorate. Maintenance should begin the very minute a road surface is opened to traffic and the higher the type of the pavement the more careful should be the maintenance.

At the outset of the Federal-Aid appropriations this fact was realized and it was made a basis of the appropriations act that any geographic or political division to receive aid should first guarantee irrevocably the maintenance of the road to be constructed.

There is one fundamental fallacy that most people still believe—that Federal Aid is in the nature of a contribution from the richer states to the poorer ones, that some states gain while others suffer. The income of the Federal government comes almost wholly from three sources—internal revenues, postal receipts and customs revenues. By far the greater part of the expenditures cannot be allocated by states, such expenditures as those for the maintenance of the government, army, navy, etc., while others such as those for postal service, public buildings, rivers, harbors, highways can be allocated and vary between the states as necessity demands. These latter are distributed on practically the same percentage scale as the collection of Federal income.

The division to states of Federal Aid highway funds is determined specifically by the taxable wealth of the state, the area, and the population, the latter two factors receiving by far the greater consideration.

The most recent Federal Aid act, that of November 9, 1921 (not considering the one that was approved June 19, 1922, which only carries the change that the maximum Federal Aid per mile shall be reduced from $20,000 to $16,250 for 1923 and $15,000 thereafter, and that the total appropriation for all states be reduced to $50,000,000 for 1923; $65,000,000 for 1924 and $75,000,000 for 1925), carried with it radical changes from the ones preceding. One change was that a state highway system be designated by each of the state highway departments, which connected properly with the systems of its bordering states and which would not contain a greater mileage than seven per cent of the total road mileage of the state. Of this system, 3 per cent is designated as the primary, or interstate roads, and the remaining 4 per cent as the secondary system. Each state is required to spend at least 60 per cent of the funds on the primary system, and if it desires, may spend the entire appropriation on it. The standards for the primary roads were raised also, requiring as one change, a surface width of 18 ft. minimum where before 16 ft. minimum had been specified. The requirements for the secondary system were not changed.

Duties of State Highway Departments

Some with vivid imaginations can picture the vast amount of work demanded of various state highway departments, when they had to obtain the entire road mileage in their states, rework plans which had been supposedly furnished, before additional work could be awarded to contract, and prepare what is termed as "interim data" for each project to be let, before authorization could be had from the U. S. Bureau of Public Roads to advertise for bids. The principal component part of this interim data is a map which shall show the location of the proposed project and the connecting sections of road between population centers sufficiently larger to be determining factors in the selection of the highway, also all alternate routes between these points, together with interconnecting roads. The preparation of these maps, as an incident, is no small undertaking.

The U. S. Bureau of Public Roads, through its rigorous requirements, has trained from infancy a state highway department in practically every state in the union. By being required to have a state highway department, the citizens of these states are coming to realize the importance of high class roads and are beginning to demand the provision of funds for the building of the systems. The Bureau, as is generally recognized, has probably caused much delay by having established certain fixed and inflexible rules and requirements but, in the end, the time lost by these petty and technical exactions will be regained many fold by its assistance in developing a thorough and efficient state organization.

Last year $600,000,000.00 were spent in the United

(Concluded on Page 154)

Repaving the Washington Boulevard of Chicago

By JOHN B. HITTELL

WASHINGTON BOULEVARD from Halsted Street to Ogden Avenue, under the jurisdiction of the West Chicago Park Commissioners, is being repaved with a standard 2 in. sheet asphalt wearing surface upon an asphaltic concrete (black base) foundation. The roadway width is 48 ft. and the length 4630 ft; the square yardage approximates 26,000. The Commonwealth Improvement Company of Chicago, being the lowest bidder, secured the contract.

While nominally a boulevard the layout of the street with its half or staggered intersections is such that heavy traffic will be permitted in going between intersecting outlets. There are thirteen streets leading onto the boulevard at intervals of about 330 ft. from which unrestricted traffic will cross over or use the street to the next nearest intersection. Halsted Street, the eastern terminus of the improvement is only a mile and a quarter from Lake Michigan and lies at the door of the west side manufacturing district. Within the limits of the improvement the street has long since passed the state of a residential boulevard, and is fronted by many manufacturing or heavy trucking concerns. Among these may be mentioned the National Biscuit Co., Post Office Garage and the Chicago Machinery Exchange. These conditions, the general disturbance of the macadam foundation prior to the present paving operations, and a small increase in elevation of the new surface were among the

(Concluded on Page 154)

Traffic and Transportation Regulations

Tentative Recommendation Presented by a Committee of the American Society for Municipal Improvement

THE following report on Traffic and Transportation was presented at the Cleveland Convention of the American Society for Municipal Improvement, held October 9-13, 1922. It is devoted to tentative recommendations and the committee consisting of A. H. Blanchard Ann Harbor, Mich., Chairman, Robert Hoffman, Cleveland, Ohio, and Charles O. Biyd, Beckley, W. Va., invite criticisms and suggestions prior to July 1, 1923, relative to the several subjects presented therein as it is the intention of the committee to present recommendations relative to these subjects for final adoption at the 1923 convention of the Society.

Weights and Dimensions of Motor Trucks. Members of the society are urged to discuss with the members of their state legislature the following dimensions and weight regulations for motor trucks with a view to incorporating sane regulations in state laws which would be effective in all cities within a state passing such legislation.

1. Maximum width of motor truck chassis or body —96 in.
2. Maximum overall height from base of tire to highest point of vehicle or load—12 ft., 6 in.
3. Maximum overall length vehicle, body and load —30 ft.
4. Maximum overall per linear inch of width of solid rubber tires, measured at the base of the rubber—800 lb.
5. Maximum gross weight on one axle—22,000 lb.
6. Maximum gross weight of motor truck and load —28,000 lb.

In its 1923 report, your committee intends to present recommendations pertaining to trailers and maximum speeds for motor trucks and trailers operating within cities on different classes of streets for different types of motor trucks and trailers and would appreciate the cooperation of members of the society in submitting recommendations to its chairman before July 1, 1923.

Financing of the Reconstruction of Streets. Your committee submits, for your consideration, the proposal that the cost of reconstructing pavements and foundations on streets in business districts and main through trunk thoroughfares be financed by general appropriation and in no cases of such streets by assessment against abutting property.

License Fees For Motor Vehicles: Your committee asks criticisms of the following tentative conclusion: That no license fees be charged for the operation or ownership of motor vehicles by any city but that all such license fees should be collected by the state and that a certain proportion thereof should be distributed to the cities by the state and be credited to the street maintenance funds.

Franchise for Freight and Passenger Highway Transport Intercity and Rural Express Companies. Your committee tentatively recommends that each highway transport company operating an express freight or passenger service on a definite route and in accordance with a time schedule should be required to obtain a franchise from a state commission, particularly appointed for this purpose, and should be required to secure the permission of all cities through which it operates to use a definitely prescribed route therein.

Sign Posting for Through Routes in Municipalities: Your committee suggests that, at all corners at which turns are made on through routes in municipalities, direction signs be erected and, at the city limit on each route, a large map sign be erected, which will show the plan of all throcgh routes in the municipality, giving the names of the streets and the principal adjoining cities to which each route leads.

Safety Car-Stop Zones: Your committee tentatively recommends that raised car-stop safety zones be universally employed in place of safety zones designated by limit lines, stancions or mushroons. Your committee also recommends that no stopping, ranking or parking be allowed at the curb opposite the safety zones and for a distance of ten feet each side of the safety zones.

Railroad Grade Crossings Within Municipalities: Railroad grade crossings are a constant source of accidents. It is evident that their total elimination is desirable but fortunately is not practicable in all cases in the present state of the financing of highway improvements. Much can be done by proper design to reduce traffic hazards in the case of railroads crossing highways at grade. A clear sight of the railroad crossing for 500 ft. on each side materially reduces aicidents and a clear sight of the railroad for a 1000 ft. on each side of the highway is desirable. The width of all roadways crossing railroads should be at least 20 ft. For a distance of 100 ft. on each side of the railroad, the grade of the highway should be level or not over 2 ft. rise or fall in 100 ft. The suggestion by some officials to construct humps in the highway to slow down traffic approaching railroad crossings is unreservedly characterized as pernicious. Proper danger signs should be located at 200 ft. each side of grade crossings in municipalities and, in sections which are poorly lighted at night, a large electrically rectangular sign carrying the word "Danger" in red letters should be suspended directly over the center of the street at the grade crossing.

Traffic Regulations for Municipalities: Your committee recommends the adoption, as far as practicable, of uniform traffic regulations for vehicles and pedestrians in municipalities. It is the intention of the committee to present a complete set of fundamental regulations in its 1923 report. In this report, there is included only regulations relative to which there may be differences of opinion. It is requested that the members of the society discuss these regulations with the Chief of Police of the city in which they reside and submit suggestions and criticisms to the chairman of the committe prior to July 1, 1923.

VEHICULAR TRAFFIC REGULATIONS .

1. No person shall operate an automobile, motor cycle or other motor vehicle on any street or public highway in the business or public highway in the business portion of the municipality at a greater rate of speed than 15 mi. per hr. or on any boulevard, drive or parkway at a greater rate of speed than 16 mi. per hr., provided such parkway or boulevard drive shall have signs placed at the entrance thereof to indicate such rate of speed, or on any street or public highway elsewhere in the municipality at a greater rate of speed than twenty miles an hour.

2. Vehicles turning to the left into another street shall pass to the right of and beyond the center of street intersections, before turning, and in congested districts where traffic policeman are stationed at street intersections, an approaching automobile or vehicle shall signal the officer and shall not pass such officer until receiving proper siginal from said officer.

3. Any person or persons operating or driving any motor vehicle or other vehicle shall, at the intersection of any public street or highway, within the limits of the municipality, keep to the right of the intersection of the center of such street or highway when turning to the right of such intersection.

4. When vehicles approach an intersection of two or more public streets or highways the vehicle approaching from the right of the driver shall have the right of way

5. No vehicle shall turn to proceed in the opposite direction except at street intersections.

6. A vehicle shall not stop on a crosswalk nor within the intersection of two or more roadways.

7. No vehicle shall stop on any street, except within one foot of the curb, or in such way as to obstruct free passage on the street, provided that this rule shall not apply when a driver of a vehicle is compelled to stop for a standing car.

8. Drivers of motor vehicles before starting, turning, stopping, backing or changing their course, shall make sure that such movement can be made with safety and shall give definite visable signal of such intention.

9. No vehicle shall stop anywhere in the city with its left side to the curb.

10. Each bicycle shall be equipped with a suitable horn or bell for giving warning or signal of its approach and, during the hours when lights on the streets are lighted, shall be equipped with a suitable head light.

11. The chief of police may, from time to time, prohibit or regulate the stopping, ranking or parking of motor vehicles or other vehicles in any district where such stopping, ranking or parking will interfere with traffic or the public safety, and no vehicle shall be parked at any time within 15 ft. of any fire hydrant.

12. Not more than two persons shall occupy the front or driver's seat of an automobiile, except that a child less than ten years of age may occupy the front or driver's seat as a third person and no person, adult or minor, shall be seated in the lap of the driver nor shall the driver be seated in the lap of a person when the automobile is in motion.

13. No motor vehicle having an over-all length greater than 20 ft. shall be diagonally or perpendicularly parked at a street curb except when loading or unloading.

PEDESTRIAN TRAFFIC REGULATIONS

1. Except where safety zones are established pedertrians shall stand on the sidewalk while waiting for street cars until the street car is within 200 ft. or less from the stopping place and when alighting from street cars pedestrians shall not stand in the street but shall proceed immediately to the sidewalk to the right, except where safety zones are provided.

2. Pedestrians shall not step from the sidewalk nor from between or back of vehicles in crossing a street without looking in both directions to see approaching vehicles, and shall cross only at right angles with the street.

3. It shall be the duty of all pedestrians to observe the line of traffic at street intersections and to obey the signal of policemen who are directing the movement of such traffic and they shall not cross before the signal is given for the traffic to move in the direction toward which the pedestrians are crossing.

4. Pedestrians shall not cross street intersections diagonally but they shall cross only one street at a time using a crosswalk, if designated, or otherwise shall cross at right angles with the street.

5. Pedestrians crossing the street in the congested district or the business district or crossing any main thoroughfare, shall do so only at street intersections or cross walks. Pedestrians crossing any street at a point other than a street intersection or cross walk outside of the congested district or business district or main thoroughfares shall exercise due diligence for their own growth of completed Federal-aid roads during the present protection and safety.

It is doubtful whether transverse cracks in concrete foundations can be entirely eliminated by any of the present-day methods of construction. Fractures in foundation work occur chiefly owing to the contraction of the concrete between its initial and final setting, this period usually extending for about three months. Although these cracks are concealed when surface covered, they exist nevertheless, and are attributable to subsequent subsidences and also cracks occuring in asphalt surfacings laid on a concrete bed. From actual experience it has been found that contraction cracks are reduced to a minimum if the work is carried out during the colder months of the year, and it would appear to be advantageous, where possible, to restrict concreting works to this period.

Testing for Better Skew-Arch Bridges

A REINFORCED concrete skew-arch bridge one-fourth the size of a full-size bridge has been built by the U. S. Bureau of Public Roads and is being "tested to destruction" to gain information that will make possible the building of stronger structures of this type.

There are many locations where it is necessary to carry a highway diagonally across a stream, and under such conditions it is customary to build what is known as a skew bridge, and when that bridge is an arch, the arch is known as a skew arch, the abutments or supports not being at right angles with the roadway. When the abutments are at right angles to the axis of the arch the structure is known as a right arch.

Model Skew-Arch Bridge Being Tested By U. S. Bureau of Public Roads

Right arches can be designed very economically, but there is a great difference of opinion with regard to the economical design of the so-called skew arch, the principal difference of opinion among engineers being with regard to the manner in which the load is transmitted to the abutments. In the right arch the load on the abutments is the same for each foot of length, but on the skew arch this probably is not the case, and the important question to be settled is the distribution of the load from one end of the abutments to the other.

It was with this object in view that a series of tests has been started on skew arches by the Bureau. At the present time the Bureau has under way at its Arlington Experiment Station a test on a skew arch designed to be one-quarter the size of an actual structure. The arch being tested is 7 ft. in span, 4½ ft. in width from face to face, and 4 ft. in height above the base of the abutments. The crown or midpoint is 2 in. in thickness and the barrel of the arch is reinforced with ¼-in. bars bent very carefully into the correct shape.

The arch is being tested with a uniform load and this loading is being accomplished in a unique manner, as follows: 42 spiral springs, each capable of carrying a load of 1,500 lb., are placed at uniform intervals on top of the arch and each spring supports a 2-in. pipe, which in turn bears against a solid overhead structure. By adjusting the lengths of these pipes the springs are deflected and the amount of load applied to the arch may be controlled by the amount the springs are compressed. In this way it is possible to obtain fine adjustments in the amount of load applied without the necessity for piling on heavy weights. As the load is increased on the arch it deflects and the concrete and steel are deformed or strained, and the engineer wants to know how these strains are distributed.

For the measurement of strains in the concrete a device known as a strain gage is being used. With this device it is possible to detect strains with an accuracy of 0.0002 of an inch. By carefully measuring the strains throughout the arch it is possible to determine the manner in which the stress is distributed and it is believed that through a series of such tests enough information will be obtained to enable the engineer to formulate rules for the economical design of skew arches.

In addition to determining the strains in the arch, the observations include measurements of deflection of the arch under load as well as measurement of the stress in the tie rods between the abutments.

Concrete Road Construction

In a contribution to The Roadmaker, for September, Mr. Ernest Worrall, engineer and surveyor to the Stretford Urban District Council, refers to the very general belief that it is unsafe to undertake road concrete work in the winter months.

A third of the year can thus be lost, and the writer of the article would not on that account defer or discontinue such work; but precautions must, of course, be taken to protect new concrete from frost, especially overnight, and the mixing and laying process be withheld during actual freezing temperatures. A greater deterrent to this and similar work in the winter season is the shorter working-day and the consequent relatively lower output and higher cost of the employed labor. Records show that forecasts of the severity of the winter season are more or less unreliable, and the chances are, in our latitude, that "working" weather will be experienced with but limited exception.

Of equal importance to protection from frost is protection from the heat of the sun. The surface and unequal evaporation and contraction caused by the direct rays of the sun, besides the too speedy setting and resulting weakness, are preventable by shielding newly laid concrete with canvas sheets kept moist with sprinkled water. The sheets at night should be raised on a light structure so as to admit freely air and ventilation to the concrete.

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A YEAR'S DEVELOPMENT

Ten thousand miles of completed Federal-Aid highways were added to the mileage of the Nation's good roads during the last fiscal year, according to a compilation just completed by the U. S. Bureau of Public Roads. The Bureau also finds that the present calendar year has broken all records for road construction. Based on all available data, which are not complete, however, the total sum to be spent in the United States this year on highway construction is estimated at $742,000,000. The figures include Federal-aid roads and projects built in addition by the states and smaller municipal units withoutthe aid of Federal funds.

At the beginning of the last fiscal year, according to the Bureau's figures, the total mileage of completed Federal-aid highways was 7,500. There were under construction at that time an additional 18,000 miles in various stages of completion. The close of the fiscal year finds the total completed mileage of Federal-aid roads more than doubled, reaching a total of 17,700 mi. Federal-aid highways under construction at the end of the fiscal year totaled 14,500 miles, which in the aggregate were estimated to average 56 per cent of completion.

Total mileage of Federal-aid highways completed during the past year was highest in Texas with 933 mi. Five states—Arkansas, Georgia, Iowa, Minnesota, and North Carolina—each reported more than 500 miles of Federal-aid highways completed within the year and two states, Montana and Wisconsin, completed more than 400 mi. each.

More than thirty miles of bridges have been built on Federal-aid highway projects since 1916. One of the longest of these, the bridge from Mandan to Bismarck, N. D., is more than 3½ mi. in length and cost $1,428,000, of which the Federal Government contributed 50 per cent.

HIGHWAY CONFERENCE TO CONSIDER TRAINING OF MEN TO ADMINISTER PUBLIC FUNDS

The second national conference on education for highway engineering and highway transport will be held in Washington, D. C., October 26, 27 and 28. Approximately 400 educators, highway engineers, government officials, and manufacturers of automotive vehicles and equipment are expected to attend.

Among the notable addresses will be one by the Honorable Pat Harrison, U. S. Senator from Mississippi, on the subject, "The Relation of Adequate Highway Transport Facilities to National Progress." His address will open the conference Thursday morning, October 26, in the New Willard Hotel. He will be followed by Major General Lansing H. Beach on the twin subject, "Relation of Adequate Highway Transport Facilities to National Defense." These speakers will share the first session of the conference with Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads, and E. S. Jordan, representing the National Automobile Chamber of Commerce, who together will discuss the subject, "Highway Engineering and Highway Transport Fields and Their Need for Trained Men." Mr. MacDonald, in his capacity as chief of the Federal bureau charged with the administration of Federal-aid road funds, is one of the outstanding figures planning for a system of national highways. Mr. Jordan speaks for that vast new industry engaged in the manufacturing of automotive equipment which will use the roads. The final speaker of the morning will be Dr. C. F. Scott, Yale University, president of the Society for the Promotion of Engineering Education. His subject will be "Education for Leadership."

An international flavor will be given the conference by an address by A. W. Campbell, Commissioner of Highways, Ottawa, Canada, who will speak on the subject, "The Trend of Education for Highway Engineering and Highway Transport in Canada." Of especial interest to educators, for whom the conference was called primarily, will be addresses by T. R. Agg, professor of Highway Engineering, Iowa State College, Ames, Iowa, and Arthur H. Blanchard, professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Michigan. They will discuss the subject, "The Trend of Education for Highway Engineering and Highway Transport in the United States."

An evening session is planned for the same day, a dinner at which Dr. John J. Tigert, U. S. Commissioner of Education, who also is chairman of the Highway Education Board, presides. Among the speakers will be George M. Graham, Cleveland, Ohio, representing the National Automobile Chamber of Commerce, and Dean A. N. Johnson, College of Engineering, University of Maryland.

The conference will continue three days. Although it is planned largely for engineering educators who are concerned with the problems of revising courses of study for the young engineer planning to enter highway and automotive fields, there will be ample features of interest to laymen concerned in the proper construction and financing of highways. An unusual feature of a highway conference will be an address by W. H. Lyford, vice-president of the Chicago and Eastern Illinois Railway. His subject will be "Cooperation Versus Competition Between Motor Truck and Railroad Transportation."

FALL LETTING OF ROAD CONTRACTS NOW FAVORED BY 17 STATES

In accordance with the recommendations made by the Highway Division of the Associated General Contractors of America at the annual meeting in Cleveland, special efforts are now being made to explain to state highway officials and others interested that the main idea behind the suggested plan was not necessarily to award contracts in the fall but to award them well in advance of the construction season, and with a greater degree of continuity where possible. This principle has been approved by a majority of the highway departments, and a great number of them have awarded a considerable portion of their work between September and March.

To ascertain how the plan was working out the Association communicated with all the state highway departments a short time ago and received reports from 32 or about 70 per cent. These reports showed that a majority of the states which followed the plan for early awards in their 1922 program were in favor of the plan and found it advantageous. There were, however, considerations which, in numerous instances, prevented its successful operation. These were:

1. The contractors' difficulty in financing, in those states where materials delivered could not be paid for.
2. The late date of approving appropriations and making necessary financial arrangements.
3. The lack of cooperation on the part of some of the contractors.

Relative to the first item, the contractors were able to go only a limited distance in storing the materials as a department was unable to make payment upon them until they were incorporated in the work.

Relative to the second item, many state projects depended upon financial arrangements with counties or road subdivisions, and these could not be consummated in time to award contracts in advance of the construction season.

Relative to the third item, some of the highway departments reported that the contractors were apparently delaying operations in search of better prices and labor rates, or did not, for other reasons, see fit to take advantage of early awards.

An analysis of the reports from the different state highway departments shows the following.

1. Nineteen states out of the 32 adopted a plan for their 1922 program; five on account of climatic conditions make their awards independent of seasons, and eight for various reasons did not adopt the plan.
2. The number of men given employment on account of the off-season work ranged from 100 to 5,000. The probable average appears to be in the neighborhood of about 800.
3. The number of men that could be employed if the system was carried out as far as possible was estimated at from 100 to 6,000. The probable average appears to be about 1,000.
4. Of the 19 states that awarded contracts in advance, 15 reported that the work had, under these contracts, reached a further stage of completion than under those awarded under the old system. Four reported that the projects were not advanced and no advantage had been realized.
5. Seven states reported good cooperation of the contractors, seven reported poor cooperation, and 18 did not mention the question.
6. Approval of the early award plan given by 17 states, while five considered it unnecessary on account of climatic conditions, and two were decidedly opposed to it. These two were Maryland and Ohio.

Judging from the attitude and expressions of the state highway departments, it may be said that the plan is generally favored and with further educational publicity can be almost universally established in those states where it is applicable.

MANUFACTURERS HOLD CONFERENCE TO CONSIDER MUTUAL PROBLEMS

A better understanding between equipment manufacturers and general contractors on questions of credit, repair part service, standardization and other problems of mutual interest promises to be the result of the joint conference between the representatives of 30 or more manufacturers and the Executive Board of the Associated General Contractors of America held in Detroit, October 3.

A joint committee of 15 manufacturers and contractors was appointed to consider the problems taken up and to make a report with recommendations as to action not later than December 1.

On this committee representing the manufacturers are: C. E. Bement, Novo Engine Co., Lansing, Mich., chairman; H. B. Bushnell, Western Wheeled Scraper Co., Aurora, Ill.; F. H. King, Marion Steam Shovel Co., Marion, O.; C. D. McArthur, Blaw-Knox Co., Pittsburgh, Pa.; H. H. Baker, Sterling Wheelbarrow Co., Milwaukee, Wis.; H. M. Hart, General Motors Co., Detroit, Mich.; representing the general contractors: W. A. Rogers, Bates and Rogers, Chicago, Ill.; S. D. Moore, Moore and Young, Waterloo, Iowa; A. P. Greensfelder, Fruin-Colnon Contracting Co., St. Louis, Mo.; W. D. Hill, Samuel Gamble Co., Erie, Pa.; Frederick C. Cranford, Brooklyn, N. Y.; W. A. Walbridge, Detroit, Mich.

The discussion during the conference was vigorously presented by leaders on both sides, and both in spirit and substance, was a surprise to contractors and manufacturers alike. Its success convinced the Association that a move in the right direction had been made and that every effort should be made to put into action the suggestions offered.

RECIPROCITY IN THE PRACTICE OF PROFESSIONAL ENGINEERING

The Council of State Boards of Engineering Examiners representing 16 states in conference October 2 and 3 at the Congress Hotel, Chicago, agreed upon rules for the reciprocal registration of professional engineers. These rules provide that an engineer registered in one state may be permitted to practice in other states which are parties to the reciprocal registration agreement. The articles of agreement prepared by the conference will be sent to the various State Boards of Engineering Examiners and will become operative as rapidly as signed by the various boards.

A resolution was passed by the conference that each state board endeavor to have state laws changed where necessary so as to allow an engineer going into another state to practice under reciprocal registration without the payment of another fee.

Reciprocal registration with Canada and Mexico was provided for in the appointment of an investigating committee. At the present time engineers going into Canada cannot practice unless registered in Canada. Mexico has given notice that American engineers will not be allowed to practice in Mexico without equal recognition for their engineers.

The various states were represented at the conference as follows:

Arizona, G. M. Butler; Colorado, R. J. Grant, R. G. Hose; Florida, G. K. Armes, H. D. Mendenrall, C. H. Ruggles, C. S. Hammatt; Indiana, C. A. Walb; Illinois, T. L. Condron; Iowa, L. M. Martin; Louisiana, Marcel Garsaud; Michigan, J. J. Cox; Minesota, F. W. McKellip; New Jersey, T. J. Wasser; North Carolina, P. H. Daggett; Oregon, O. Laurgaard; South Dakota, John Berg; South Carolina, T. Keith Legare; West Virginia, George E. Taylor; Yyoming, Frank C. Emerson.

C. S. Hammatt, president of the National Council, presided and R. G. Hosea was secretary. The following new officers were elected; J. J. Cox, president, chairman of the Michigan State Board of Engineering Examiners, Ann Harbor, Michigan; vice president, O. Laurgaard, president, State Board of Engineering Examiners, 520 Corbett Bldg., Portland, Oregon; secretary, P. H. Daggett, State Board of Engineering Examiners of North Carolina, professor of electrical engineering, University of North Carolina, Chapel Hill, N. C. The next annual meeting will be held in Chicago.

One thousand three hundred and fifty-two mi. of road has been completed by the U. S. Bureau of Public Roads in our national forests, and there is under construction 617 miles, which open up regions of great natural beauty and rich in natural resources.

Calendar of Coming Meetings

FEDERATED AMERICAN ENGINEERING SOCIETIES, Washington, D. C.; Annual meeting Washington, Jan. 11-12, 1923.

AMERICAN RODEBUILDERS ASSOCIATION, New York City; Annual Convention, Chicago, Jan. 15-18, 1923.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual meeting, New York City, Jan. 17 and 18, 1923.

AMERICAN CONCRETE INSTITUTE, Detroit; Annual Convention, Cincinati, Jan. 22-26, 1923.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual meeting, Los Angeles, Jan. 30-Feb. 3, 1923.

MOVEMENT OF HIGHWAY MATERIALS IMPROVING

A slight improvement is reported in connection with the transportation of construction materials used in road building. This is due to the practical settling of the railroad strikes, which has been followed by an improved service on the rail line and by a slight letting up of the rigorous character of regulations covering the transportation of coal, issued by the Interstate Commerce Commission.

Incidental to this situation as it affects road-building projects is the passage by Congress of two bills, one aving to do with the apportionment of coal, and the other with the creation of a fact-finding commission to investigate the coal situation.

PAVING PATENT UPHELD

Immense costs of litigation plus hundreds of thousands of dollars in royalties—in all a bill which may exceed $300,000—is what will have to be stood by the state highway fund of Oregon as a result of years of demagogic agitation against paying anything for the right to use patented paving. This $300,000 might have been expended for miles of paving and roadbed construction had it not been wasted in this attempt to overturn a patent that had been held valid by the highest federal courts every time its validity had been brought before them as an issue to be decided.

Year after year the legislature of Oregon has refused, by ever-decreasing majorities, to enact legislation directed against patent paving· About three years ago, however, shortly before the paving patent expired, legislation was enacted directing the attorney-general and the state highway commission to use the type of paving regardless of the patent and fight the patent in court in order to avoid payment of royalty. With this legislative direction, there was nothing for the highway commission to do if it desired to use this type of paving but to use it and fight the patent. In this way the issue was brought into the federal court.

In defiance of this patent right, the state contracted for about 1,200,000 yd. of the patented type of paving, and entered into contract with the contractors to protect them from infringement suit. This was according to the legislature's instruction.

Prior to that time, millions of yards of this same type of patented paving had been contracted for by the highway commission on a competitive basis—type against type, with price considered in proportion to quality. The matter of royalty did not enter into the award—that was fixed after open bidding on a competitive basis. It was a matter of common knowledge that the competition was so keen that the amount of royalty figured in the price was only ten cents a yard.

But with defiance of the patent and use of it regardless of its proven standing in court, the patentee was in a position to sue for his full royalty of 25 cents a square yard—which on 1,200,000 sq. yd. amounts to $300,000. The test suit was brought against one contractor only, and covered only 75,000 yards. Judgment for the full 25 cents a yard was awarded by the federal district court, the opinion being handed down by Federal Judge Robert S. Bean.

This opinion shows that the opposition to the patent through all these years had not a leg to stand on. Everybody who had studied the facts knew that this was the case, but the agitation was kept up regardless of the facts. No decision could be more sweeping in its denial that there was any real justification for having brought the case into court at all.

This decision, except for the appeal with its inevitable result, is the end to an agitation which has torn the state for years—except that the bill must be paid to the tune of several hundred thousands of dollars which otherwise might have been expended for much-needed road construction.

More than 1000 miles a month has been the rate of growth of completed Federalaid roads during the present working season. The mileage completed on August 31, according to data compiled by the U. S. Bureau of Public Roads, totaled 19,308, of which 6,401 miles have been added since the beginning of the year. On the same date there was under construction 14,670 miles. Federal-aid roads in all stages, from approved projects to completed roads, now total 41,405 miles, or 23 per cent of the system of highways being outlined by State and Federal engineers to serve the whole country, and which will consist of approximately 180,000 miles.

Equipment — Trade — Materials

MACLEOD ASPHALT SURFACE HEATER

The surface heater illustrated is manufactured by The Macleod Company, Cincinnati, Ohio, builders of a number of types of contractors and street repair equipment. It is of the indirect heat type, in that the flame does not come in direct contact with the pavement but is sent into an upper chamber from which the heat issues into the lower one and on to the work. This process is necessary especially where volatile mixtures are used in paving and repair work, as it would be dangerous for the flame to be thrown directly on them. With this process over 90 per cent of the heat is utilized.

Spaces up to 48 in. by 72 in. can be heated and the heater can also be backed up to the repair work and started almost instantly. The heat is spplied by 3 oil burners which give a long, powerful flame. The feature of this outfit is that the hood can be lowered to the work or raised to any position as it is self locking no matter where placed. All this is done by simply operating the small hand lever shown at the side, which works a worm and a worm-wheel and through to the little winding drums.

"A TIME STUDY OF CURB CONSTRUCTION"

The Heltzel Steel Form & Iron Company of Warren, Ohio, have recently issued a four page folder entitled "A Time Study of Curb Construction." The folder gives a very careful comparison of wood forms versus steel forms, and cites examples to show the relative cost of a job employing both methods. In one particular case the wage cost for setting 300 ft. of curb forms was only $3.30, whereas, to do the same work with wooden forms would require a total wage cost of $28.80.

The folder also describes the mechanical details of the forms and their methods of use.

The Link-Belt Company of Chicago, Philadelphia and Indianapolis announces the completion of a new General Catalog No. 400 which embraces their entire line. It is the most complete book they ever issued on this subject. It contains 832 pages, is cloth bound and can be obtained from any Link-Belt Branch office. The catalog also includes the products of the H. W. Caldwell & Son Company plant of that company.

FEDERAL AID FOR STATE HIGHWAYS

(Concluded from Page 146)

States for road building but even at this rate and rate of increase, highway building seriously lags behind the increase of the rolling stock for these highways. For a single state the contracting a highway system is an enormous undertaking. There can be no efficient administrative, engineering, or financial policy, unless this business is kept free from partisan policies and the employment of personnel be determined by competency and service. The science of highway development is being rapidly developed. We have made wonderful progress during the past two years, and especially during the year 1921. The work of building roadbeds for the rolling stock already in existence will extend over more than a decade into the future and it will be with the public to determine whether the established policies shall be carried out or whether there shall be a change with every change of the administration. If permanent policies can be adopted and carried forward without change over a period of years the necessary roads can be built without undue burdens upon the public. The public have undertaken the responsibility of building roads and there should be no misunderstanding of the huge sums which are involved in the undertaking.

REPAIRING THE WASHINGTON BOULEVARD OF CHICAGO

(Concluded from Page 146)

reasons prompting the Commissioners in selecting a resilient instead of a rigid base for the wearing surface.

Mr. Wm. G. Barclay, Superintendent, West Chicago Park Commissioners, in speaking of the improvement said:

"This part of Washington Boulevard was paved with asphalt in 1893 and some of the intersections were repaved in 1906.

"The areas of the numerous intersections as well as those of parts of the roadway from which heavy or truck traffic cannot be barred owing to the fact that many of intersecting streets do not continue in line across the roadway, summed up, are probably 50 per cent of the entire area—so that in effect the pavement will be subjected to a traffic similar to that on any business street nearby.

"The disturbance of the old macadam foundations was very general—one corporation made openings every 25 ft. along the street—and much rehabilitation work on underground services was necessary due to the period of 28 years between the placing of the pavement in 1893 and this.

"The Commissioners, knowing that additional materials were needed to provide a proper foundation carefully considered the merits of portland cement concrete and black base. Their investigations of the bituminous type of foundation in several cities, and the opinion of the engineers experienced in pavement construction convinced them that the black base would be the better of the two, being resilient it absorbed some of the shock of impact of traffic, thus protecting both the wearing surface and the macadam base; the binder course could be eliminated, and that the work would progress more rapidly as no time would be lost as in waiting for an hydraulic concrete base to cure, an important consideration of this time of the year and the demands of traffic."

The placing of the black base involved no methods of construction differing from those commonly employed in laying binder. Where the depth of it was more than 3½ in. the base was laid in two courses.

Standard Mexican asphalt produced by the Standard Oil Co. of New Jersey is used in the asphaltic concrete base and wearing course, typical analyses of which are as follows:

BASE

	Per Cent.
Bitumen	4.9
Passing 200 mesh	2.0
Passing 80 mesh	9.5
Passing 40 mesh	5.6
Passing 10 mesh	3.1
Passing 4 mesh	10.2
Passing ½ mesh	10.6
Passing ¾ mesh	28.4
Passing 1 mesh	11.7

WEARING COURSE

	Per Cent.
Bitumen	10.0
Passing 200 mesh	12.3
Passing 80 mesh	29.9
Passing 40 mesh	37.7
Passing 10 mesh	10.1
Penetration of Asphalt Cement	41.

For the West Chicago Park Commissioners Wm. G. Barclay, superintendent, has general charge, while Wm. G. Keith, engineer, Thomas Newton, field engineer, and Wm. A. Basse inspector, are responsible for details of office construction work. Messrs. Alexander Todd and Walter Leininger, constituting the Commonwealth Improvement Company, are giving particular attention to the construction with Wm. G. Foley as foreman in charge.

Accidents on the highways could be greatly decreased by the passage of uniform state laws requiring every truck to carry a mirror, giving a view of the road immediately to the rear, and by requiring every horse drawn vehicle, as well as automobiles, to display some sort of light when using the roads at night. This is the opinion of M. O. Eldridge, director of roads of the American Automobile Association Good Roads Board, after making a careful digest of the traffic laws of all the states of the Union. Mr. Eldridge, in a report to the Secretary of Commerce sets forth that thirteen states have laws requiring the mirror on trucks, but that very few have any regulation for horse drawn vehicles. The states requiring mirrors on trucks are Vermont, Washington, California, Connecticut, New York, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey and the District of Columbia.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

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TABLE OF CONTENTS

The Need for Trained Men in the Field of Highway and Engineering and Highway Transport . . 155
By Thomas H. MacDonald

Klamath River Road Nears Completion 157

Cooperation Between Engineer and Contractor . . 158
By W. R. Neel

Standard Tests for Non-Bituminous Materials . . . 159

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Highway Engineers Discuss Educational Problems 160

Colonel Wm. D. Uhler Dies 161

Highway Projects Backed by Huge Sums . . . 161

Seven Years of Road Progress in Wyoming . . 161

Pueblo Commerce Club of Colorado Asks Removal of Signs 161

Four States to Vote on Highway Bonds . . . 162

Iowa Highway Work Continues Upward Trend . 162

Nebraska Department of Public Works Advocates Separation of State and County Road Control . 162

Calendar of Coming Meetings 162

Personal Mention 162

CONTRACT NEWS 33

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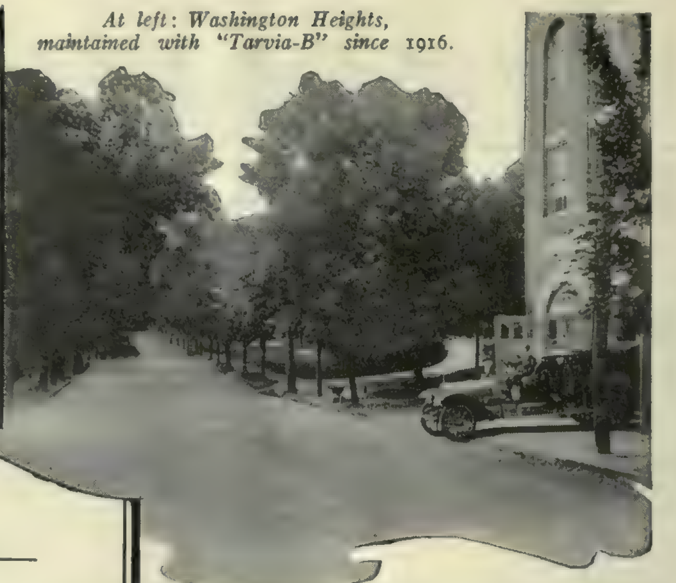
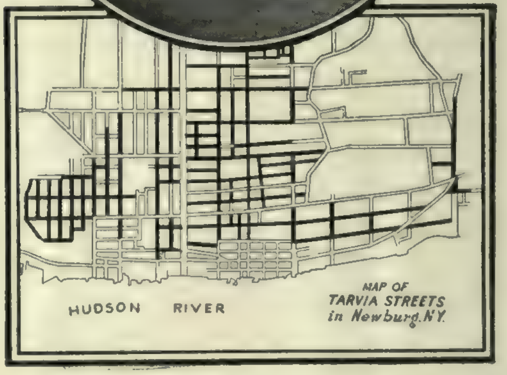
At left: Washington Heights, maintained with "Tarvia-B" since 1916.



Above: Du Bois St., maintained with "Tarvia-B" since 1916.

Below: Benkard Ave., maintained with "Tarvia-B" since 1913.



"Tarvia-B" makes good at Newburgh—

Benkard Avenue, pictured in the circle, was the first Tarvia street in the City of Newburgh, New York. It was treated with "Tarvia-B" in 1913, and again in 1914 and in 1915.

The results were so satisfactory that in 1916 other macadam streets were given their initial Tarvia treatments, and the list has been growing ever since. Not until last year, however, when the 18 miles of roadway shown on the accompanying street map were surfaced-treated with "Tarvia-B", was the use of all other kinds of road-maintenance materials entirely abandoned in favor of Tarvia.

Describing Newburgh's experience with Tarvia, Mr. W. J. McKay, City Manager, wrote under date of March 17, 1922:

"It is with a great deal of pleasure that I inform you that the results obtained from the use of your 'Tarvia B' on the streets of this city last season were more than satisfactory.

"While we are always in the market for material cheaper than the material we used the preceding season, it would take a considerable difference in price to have us make any change in the product to be used for the season of 1922."

Economy must be the goal of every conscientious public official. And officials of Newburgh, and hundreds of other cities and towns throughout the country, have found from experience that Tarvia is the most economical of all road materials. Some others may be a little cheaper *per gallon* but the small difference in first cost is much more than offset by the big difference in the result obtained.

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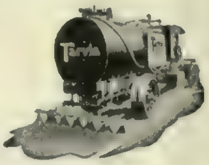

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GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE
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The Need for Trained Men in the Field of Highway Engineering and Highway Transport

By THOMAS H. MacDONALD
Chief, United States Bureau of Public Roads.

IN May, 1920, before the first conference on Highway Engineering and Highway Transport Education, it was my privilege to present a paper on a very similar subject. About the same groups made up that conference that are again represented here. The essential difference, then, is the fact that we now have to guide us three years experience in the development of a remarkable highway program of highway improvement much beyond the conception of our most adavnced ideas of only a few years since. Out of this experience there are certain tendencies crystallizing which indicate clearly and most emphatically responsibilites that must rest upon all those who are and who should be concerned with the business of education.

The Effect of the Business Cycle

At the time of the first conference, this country had been passing through a time of intense industrial activity. We are now emerging slowly from a period of the greatest contrast, a period marked by industrial depression, liquidation, and deflation. From the record as it was stated then and out of these more recent experiences, materialize the principles of a major character if measured by their effect upon the highway development of this country, and major, too if measured by the difficulty of overcoming them effectively. In outline these principles may be stated.

1. During periods of industrial activity industry takes annually a large draft of technically trained men. This is true whether applied to the young men upon whose diploma the ink is scarcely dry, or to the trained, efficient engineer of many years experience.
2. The inducements of higher compensation, sure advancement and continuity of services are offered by industry to the individual of outstanding personality and technical preparation far in advance of the offers made by the public service.
3. During the periods of industrial depression there is a drift of engineers to the public service, but, generally speaking, not of the best qualified or experienced engineers.

Elaborating the point briefly, when the depression seized upon industry, large and small, and there came a general curtailment or shutting down of activities, many engineers sought the public service field, reluctantly and generally with greatly decreased compensation. Now that, despite major handicaps, a revival and expansion of industrial and commercial activity is again ahead, we can expect the repetition of our very recent experience of having the most available and best qualified engineers attracted and deflected to other fields. It will not be very long before this cycle is completed. These principles, which are in themselves an indictment, are the prologue. If this conference is to accomplish something big, and if it is to assist, in the months and years immediately ahead, in the achievement of definite progress, it must concern itself with educational measures and policies that are broader in their application than the technical curricula of our educational institutions. It must do its part in helping to awaken and develop a real public conscience toward its own public service, and it must awaken the public's intelligence to a real appreciation of the magnitude and significance of the developing highway transportation.

The Significance of Recent Legislation

First, consider the significance of recent legislation. The Federal Highway Act of November, 1921, gave us for the first time in the history of the United States, a plan for the development of a comprehensive system of highways serving the nation by perfecting a net work into every part of every state. It contemplates the service of highways for interstate and transcontinental traffic but none the less does it provide for local traffic. It brings this major system of highways so close to the communities that a properly developed system of local roads will reach all those who are not served directly. But the direct service which will be provided by the major system itself will reach a very large percentage of our total population and carry a very large amount of the total highway traffic.

Preliminary estimates show that there will be included in the major system, which we may call the Federal highway system, approximately 180,000 miles, and even considering the improvements which have been made, it will require ten to fifteen years, perhaps longer, to complete that system. Last year we added about 10,000 miles of completed highways to this system. This year the record will be smaller, but there are included in these yearly totals a large mileage which must yet be surfaced or improved with a higher type of surfacing before the system can possibly be considered completed.

The Federal Highway Act established as conditions

Address before the Conference on Education for Highway Engineering and Highway Transport, held at Washington, D. C., October 26-28, 1922.

precedent to the continued participation of the states in the allotment of Federal aid, these principles:

1. That each state should maintain a highway department properly organized and equipped to supjervise and administer the construction of new highways, and to maintain those already built.
2. That each state must provide state funds to meet the Federal aid funds, and not be dependent upon the various subdivisions such as counties, to supply the state's quota,
3. That, (and probably most important of all) each state must provide sufficient funds to maintain the roads which are built and lift the responsibility from the shoulders of the local communities. A majority of the states have already incorporated in their state legislation these principles, and it was the result of the successful working of these principles in some states over a considerable period of time that led the framers of this Act to require their universal adoption.

The states which must change their constitutions or their laws in order to comply with these requirements are already taking the necessary steps, and it is only a question of a very short time until they are made a part of the laws of all of the states. Note that this development in legislation accepts and provides for a plan of administration and supervision universal in its application, that can be satisfied only by an engineering organization.

This conference can evaluate the degree of accomplishment for the public benefit that lies between the results that will be secured by an adequate engineering organization, and the disappointments that will result from the failures of an inadequate organization. Can the general public be awakened as keenly to this difference?

A Field With a Future

Second, the field for the highway engineer is not so limited as might first be thought. It is not sufficient that there shall be competent engineers in the public service alone. There must be equally competent men in the field of the producers and the allied activities. This field is partially covered by the following:

1. Engineering organizations such as county, municipal, state and Federal highway departments.
2. Contractors engaged in highway construction.
3. Producers or manufacturers of highway material.
4. Consulting and private engineers.
5. Commercial laboratories and inspection service.
6. Industrial educational associations.
7. Engineering and educational institutions.
8. The technical press.
9. Traffic engineers.

This latter is a new and at this time almost undeveloped field, but in the future it promises to absorb many men who will be engaged in a most valuable service. This list is not complete; there are many allied lines having relation to the general field of highway development.

Third, our production of serviceable highways is not keeping pace with the demand. Because their use, their practicability and their continuing service are dependent upon improved highways the growth and the use of the motor vehicle is the best index to the need for, and the probable future increase in the mileage of modern highways. During the little more than a decade since 1910 the number of motor vehicles in service on our public highwaps has increased more than 2000 per cent. Permit me to repeat the figures which I have used before, which indicate the lag in the development of highways of modern type over the development in the use of the motor vehicle.

1. During the period 1910 to 1921, the potential number of motor vehicles demanding highway service increased approximately 2000 per cent. Our actual expenditures for construction and maintenance of highways increased about 400 per cent.
2. During the period 1910 to 1918 motor vehicles increased more than 1100 per cent, highway expenditures about 120 per cent.
3. During the period 1918 to 1921, motor vehicles increased about 900 per cent of the number registered in 1910 and highway expenditures about 400 per cent on the same basis.

It is not asserted that these figures are directly comparable, but it cannot be disputed that they are indicative.

The Problem of Finances

Fourth, consider briefly the matter of highway funds. The total estimated expenditures for highways by all agencies and from all sources during the year 1921 amounted to more than $700,000,000. The figures for this year will probably fall somewhat below the figures for last year.

On the basis of the more conservative estimate of actual expenditures, and without attempting to fix closely the proper percentage of cost for engineering services, there should be invested annually, at the present rate, for the engineering and administrative control alone, from 30 to 60 million dollars. Considering that easily from 40 to 60 per cent, depending upon the type of work, will be used for labor, there will be available annually from 250 to 400 millions of dollars. These funds are available for the employment of skilled and technically trained men in the contractors' organizations as well as for the employment of common labor. hardly necessary to continue to tell of the large sums available, which may legitimately be used for the employment of highway engineers.

The Need, of Trained Highway Engineers

In summary, we find that the tendency of highway legislation is most favorable to the man who will consider the highway field as his future work. There are opportunities in more than a dozen of major fields directly connected with highway work. The rate of highway improvement has not kept pace with the demand which, together with the program now definitely recognized, make certain a long period of major activity.

The legitimate percentages of the total available funds which should be used for engineering and supervision are sufficient to insure employment to many men who are properly qualified and technically trained. As a commentary these facts do not, at least to me, indicate that the educational institutions should feel called upon to specialize in the teaching of highway engineering. For the graduate who would enter the highway engineering field I would personally prefer that he have a sound general course in mathematics, English, economics and kindred general subjects, rather than a number of specialized subjects. But, on the other hand, the graduate who is to enter he highway field should not be trained for some other engineering field. Referring back to the principles which were developed in the opening paragraph there is here potentially a big, attractive field for the best trained men and the extent to which these men can be brought into this field and retained will be the measure of the economy and efficiency of the expenditure of the tremendous public funds which are inevitably to go into the building and the maintenance of our public highway system.

Bigger by far than any other problem before this conference is first the problem of awakening the public to the need for and the support of the highway administrative and engineering organizations engaged in this work, and second, that of educating the public to a proper use of the highways from the traffic standpoint.

Klamath River Road Nears Completion

California Newest Highways Opens Up Vast Area

THE spectacular Klamath River road project under construction by the Federal Government for the past four years will shortly be finished and opened to the public. Although built by the Government with the primary object of opening up the vast interior region of the Klamath National Forest, with its 28 billion feet of timber, this road will have a far reaching effect upon the development of the whole northwestern part of the state.

TYPICAL CHARACTER OF ROCK BLUFF ACROSS WHICH THE KLAMATH RIVER ROAD WAS CONSTRUCTED

The construction began at the end of the Siskiyou County road near Happy Camp and followed for 50 miles down the rugged canyon of the Klamath River to connect with the Humboldt County road ending at Orleans. Although famous in the early days for its rich placer workings, this locality has been accessible heretofore only by rough pack trails and the trip from Happy Camp to Orleans, which before this consumed at least two days of hard travel, may now be accomplished by automobile in a few hours.

Not only will the new road be of immeasurable advantage to the many productive little ranches nestling in the canyons and on the bars along the river, and to the Federal government in the management of the great National Forest which it traverses, but also the closing of this link makes available a through route across the mountains from the Sacramento Valley to the coast country. Undoubtedly this route will be immensely popular with the auto tourists. From Sisson, Dunsmuir, Yreka and other towns in the upper Sacramento, it will now be an easy one-day trip by a very low, water gradient all the way down to Eureka, Crescent City and other coast points. The country through which the route passes is perhaps nearer to a wild primeval condition than any other part of the state and the rugged scenic beauty of the entire locality is unsurpassed.

From the Bay region this will offer an exceedingly popular loop trip going north to Yreka by the Pacific Highway, thence down the Klamath River to Eureka and returning south over the Redwood Highway. Picturesque scenic attractions of outstanding interest will not be the only lure for the tourist. The whole region abounds with excellent fishing. In fact, the Klamath is about the last stream left in California where salmon are sufficiently plentiful to make commercial fishing feasible. The Klamath country is famous also for its opportunities for big game hunting and the numerous Forest Service trails tributary to the new road permit the hunter to reach areas far from the beaten path.

More than four years ago the Forest Service worked out the preliminaries for the project and steadily since construction work has been diligently prosecuted under the direction of engineers of the U. S. Bureau of Public Roads. Construction has been carried from both the north and south ends and now the closing of the last gap consists merely of the finishing touches of the great steel bridge spanning the river midway on the project. The work has consisted of unusually difficult construction and has required a total outlay of about $1,200,000. All of this was provided from the appropriations for National Forest road work except $40,000 contributed by Humboldt County and the same amount from the state. Siskiyou and Humboldt Counties have pledged themselves to the Government to perform maintenance work necessary to keep the highway in a first class condition.

Relative to the project, P. G. Redington, District Forester for the California District of the Forest Service states: "The completion of the Klamath River road marks a distinct step forward in the development of California's National Forests. For many years the Forest Service struggled to break the lock of inaccessibility fastened upon many of the state's wonderful forests, but the meager funds allowed little more than the most urgent pack trails to be built.

"In recent years, however, with more liberal appropriations, great progress has been made toward supplying the needed roads and trails. Not only do these permit the government to more effectually manage the National Forests and protect them from destructive fire, but also the general public is enabled to make more full use of their outstanding attractions for recreation and commercial exploitation. It is not difficult to foresee that the penetration of a fine highway through a virgin region like the Klamath country will induce a great deal of development in the immediate locality."

This project is the largest of any yet finished in the government's program, which aims to provide National Forests of the United States with an adequate transportation system. Of recent years Congress has been according increasing recognition to the urgency of better roads and trails serving the forests, and last fall appropriated $15,000,000 for continuing the construction program.

Co-operation Between Engineer and Contractor

By W. R. NEEL

State Highway Engineer of Georgia.

THIS is a subject very often under discussion by all of the parties concerned. The engineer has his interpretation of the word co-operation, the contractor his and the owner his.

Most specifications frankly place upon the engineer all of the decisions in the carrying out of a contract. It is my belief, however, that the engineer has, generally speaking, fully realized that this authority is not given him to abuse. Fairness to both the owner and the contractor should be the goal for which the engineer strives.

Frequently contractors submit bids without either a thorough knowledge of the specifications or of the site where the work is to be executed. It is also a fact that frequently misunderstandings arise, due to the fact, that the engineer is either unfamiliar with the terms of the contract and the specifications, or that he is so inexperienced that he is not capable of properly interpreting same.

The Engineer's Duties

The first lesson to be learned by the engineer is, that he is not only representing the owner, but that he is also representing the contractor. Fairness to these two parties is the engineer's job. First, it must be recognized that the owner or beneficiary should pay the full cost agreed upon for the improvement. The second—that the contractor effecting the improvement should receive a fair compensation for his efforts, insofar as the limitations of the contract will permit. It should be the desire of the engineer to so assist the contractor that after the proper execution of the work a maximum profit can be made. It should be the duties of the contractor to so perform his work that nothing, either in the spirit of the letter of the contract, remains to be done toward securing for the owner a satisfactory job. With both the engineer and the contractor entering into their work with this spirit, true co-operation may be expected.

The laws frequently prevent the very thing for which they are written. They requently pevent the awarding of the contracts to the best bidder; frequently there are written upon the statute books maximum salaries to be paid engineers, thus preventing the state or county from securing the very best engineering service. Very often you find a resident engineer or a division engineer in charge of a great many construction jobs and clothed with full authority, who may not be competent and who frequently is paid less money than the foreman of the construction gang.

Contractors are always on the lookout for good men and good men are always on the lookout for a means of bettering their positions in life; therefore, it is imperative not only from the interests of the owner but, also, from that of the contractor that adequate salaries be allowed in order to secure and hold competent, experienced engineers. Not only is trus true of the engineers but it is also true of the contractor. A well-equipped contractor receiving a fair compensation for his work, with an experienced engineer (and generaly this means an engineer receiving a fair salary) in charge of the work means a smooth running, harmonious job where real co-operation and satisfactory results to the owner may be expected. On the contrary a poorly equipped contractor who has submitted a bid which will not allow of a first class job with a fair margin of profit, means contentions, and either the slighting of the job or calling on the bondsman, and this always means delay and ultimately a poorly finished job and a dissatisfied public.

Unfortunately all engineers are not to be entrusted with the wide powers generally given the "engineer" by the specifications. There are in every profession what corresponds to the "shyster lawyers"—that is a man who lives by making trouble. Many men employing engineers think that trouble between the contractor and engineer is to be expected and unless there is some trouble that the engineer is not looking after the job properly or is "in with the contractor". Wiith this before them there are engineers who are unscrupulous enough to make constant trouble for the contractors; the result is loss to all contractors working under them or excessively high prices for work. The only remedy for this, in my opinion, is for reputable contractors to investigate the engineer in charge of work and in case his reputation is not good to refuse to bid or work in his charge and to inform the men who employ the engineer the reason for declining to bid. Bonding companies could be required by the contractors to furnish impartial information in regard to an engineer, standing and reputation.

Another cause of trouble is placing an inexperienced engineer in responsible charge of work. Owners will employ a graduate engineer just out of college. The man may be entirely sincere in his efforts but through lack of knowledge of actual construction conditions he may, by over emphasis of some unimportant point cause a loss or at least unnecessary trouble without bettering the job in the slightest.

The Problem of Poor Contractors

A phrase of this subject which I consider a real serious one is the insistent bidding of contractors both poorly equipped and incompetent to perform a first class job, but who can get bond. This class of bidder is a constant menace to the other contractors as well as to the engineer's reputation. Of course, you know how difficult it is for a public official to eject the bid of this class of contractor. In selecting any other than the lowest bid, the public official is immediately accused of partiality and even of graft.

The inspectors and the resident engineer are supposed to be able to enforce the carrying out of the plans and specifications and secure the same result regardless of what class of contractor is doing the work. Yet, anyone at all familiar with construction knows how utterly impossible this is. To obtain first class results experienced, well equipped contractors and competent, experienced engineers and these co-operating to the best interests of the owner are absolutely necessary. Now, how can this be accomplished? In my opinion, the only practical way is for the engineer to reject all work not coming jam up to the plans and specifications.

If this is plainly understood, the results will be that contractors who are not equipped either with machinery or experience will either be deterred from bidding or very soon driven out of the contracting business. In order to carry out this plan successfully and with every assurance of fairness, specifications must be plainly written and competent engineers and inspectors placed in charge of the work.

Charleston, West Va., is said to have had the first paved street laid in the United States. In 1871 Charleston paved Summers street with building brick. These, of course, were not to be compared with the hard vitrified brick used for paving purposes today, but nevertheless they served satisfactorily for 38 years.

Abstract of a paper read before a recent meeting of the Southern District of the Asphalt Association, Atlanta, Ga.

Standard Tests for Non-Bituminous Materials

As Adopted by the American Society for Municipal Improvement at Their Recent Convention

THE following report on Standard Tests for Non-Bituminous Materials was unanimously adopted by the American Society for Municipal Improvement at their Cleveland Convention held October 9-13, 1922. It was prepared by a committee consisting of Arthur H. Blanchard, chairman, Thomas H. Brannan, Wallace L. Caldwell, Austin B. Fletcher, and Clarence D. Pollock.

Your committee recommends that the Society adopt methods of testing non-bituminous materials which have given useful, satisfactory and reliable results. It further considers that it is highly desirable that methods of conducting different tests in different laboratories should be as uniform as possible. Hence, it is obvious that, as far as practicable, methods of testing adopted by national organizations should be identical. Based on the above hypotheses, your committee has given careful consideration to the tests adopted by the American Society for Testing Materials, and those proposed by Committee C-9 on "Concrete and Concrete Aggregates" and Committee D-4 on "Standard Tests for Road and Paving Materials" of the American Society for Testing Materials and by the Special Committee on "Materials for Road Construction" of the American Society of Civil Engineers.

At the 1921 convention, the Society adopted the report of your committee which recommended that seventeen specified tests be tentatively adopted by the Society until the 1922 convention. Your Committee requested in its 1921 report, that criticisms and suggestions relative to the recommended tests be submitted to the chairman prior to July 1, 1922. No criticisms or suggestions have been received by the committee. Your committee approves the recommendations, as embodied in the 1922 annual report of Committee D-4 on "Standard Tests for Road and Paving Materials" of the American Society for Testing Materials, to substitute two new tests for the following test relative to "Quantity of Clay and Silt in Sand for Highway Construction" and "Workability of Concrete for Cement Concrete Pavements" and hence withdraws these tests and hereafter recommends that the substitute tests be tentatively adopted. Your committee now recommends that the Society adopt the following fifteen methods of testing,, heretofore mentioned, as standards of the Society:

1. Apparent specific gravity of sand, stone and slag screenings, and other fine non-bituminous highway materials, as described in the Am. Soc. Test. Mat., 1921 Standards, pages 715-718, and designated D 55-19.
2. Apparent specific gravity of coarse aggregates, as described in the Am. Soc. Test. Mat., 1921 Standards, pages 713, 714, and designated D 30-18.
3. Mechanical analysis of sand or other fine highway material, as described in the Am. Soc. Test. Mat., 1921 Standards, pages 721, 722, and designated D 7-18.
4. Mechanical analysis of mixture of sand or other fine material with broken stone or broken slag, as described in the Am. Soc. Test. Mat., 1921 Standards, page 724, and designated D 19-16.
5. Mechanical analysis of broken stone or broken slag, as described in the Am. Soc. Test. Mat., 1921 Standarts, page 723, and designated D 18-16.
6. Abrasion of road material, as described in the Am. Soc. Test. Mat., 1921 Standards, page 710, and 1918, pages 1441, 1442 and designated as D 2-08.
7. Toughness of rock, as described in the Am. Soc. Test. Mat., 1921 Standards, pages 711, 712, and designated D 3-18.
8. Crushing strength of rock or slag, as described in the Am. Soc. C. E. Trans., Vol. 82, 1918, page 1442
9. Cementation of rock, slag, and gravel powders, as described in the Am. Soc. C. E. Trans., Vol. 82,
10. Quantity of clay and silt in gravel for highway construction, as described in the Am. Soc. Test. Mat., 1921 Standards, page 719, and designated D 71-21.
11. Organic impurities in sands for cement concrete, as described in the 1921 Report, Com. C-9, Am. Soc. Test. Mat., page 12, and designated C 40-21 T.
12. Tests for portland cement, as described in the Am. Soc. Test. Mat., 1921 Standards, pages 530-547, and designated C 9-21.
13. Compression test of cement concrete, as described in the 1921 Report, Com. C-9, Am. Soc. Test. Mat., pages 6-11, and designated C 39-21 T.
14. Paving brick rattler test, as described in the Am. Soc. Test. Mat., 1921 Standards, pages 567-574, and designated C 7-15.
15. Absorption of water by wood blocks after treatment, as described in the Am. Soc. C. E., Trans., Vol. 82, 1918, page 1447.

Your committee recommends that the Society tentatively adopt, until the 1923 convention, the following methods of testing:

1. Decantation test for sand and other fine aggregates, as described in the 1922 Annual Report of Committee D-4, Am. Soc. Test. Mat., and designated D 136-22 T.
2. Consistency of portland cement concrete for pavements or for pavement base, as described in the 1922 Annual Report of Committee D-4, Am. Soc. Test. Mat., and designated D 138-22 T.
3. Sampling stone, slag, gravel, sand and stone block for use as highway materials, as described in the Am. Soc. Test. Mat., Proc., Vol. XX, Part I, 1920, pages 789 to 795, and designated D 75-20 T.
4. Mechanical analysis of subgrade soils, as described in the 1922 Annual Report of Committee D-4, Am. Soc. Test. Mat., and designated D 137-22 T.

The committee requests that all Specification Committees and members of the Society interested in tests for non-bituminous materials give careful consideration to the tentative methods recommended and submit to the chairman of the committee, prior to July 1, 1923, criticisms and suggestions relative to the proposed methods of testing, in order that the next convention may be in a position to adopt, as standards, the four tentative methods of testing referred to in this report.

Your committee believes that the primary function of the Special Committee on "Standard Tests for Non-Bituminous Materials," is to serve the Society as a Committee to review new methods and modifications of present methods of testing non-bituminous materials and to recommend to the society, from time to time, the adoption of standards and changes in such standards as may seem desirable.

Current Events in the Field of Highway Engineering and Transport

Highway Engineers Discuss Educational Problems

Second National Conference on Education for Highway Engineering and Highway Transport Held in Washington on October 26, 27 and 28

The Second National Conference of the Highway Education Board was held at the New Willard Hotel, Washington, D. C., on Oct. 26, 27 and 28, with approximately 400 delegates from every section of the United States in attendance. Dr. John J. Tigert, U. S. Commissioner of Education, and chairman of the Highway Education Board, presided.

At the opening session on Thursday morning, greetings from President Harding were read and addresses were made by Senator Pat Harrison of Mississippi, on "The Relation of Adequate Highway Transport Facilities to National Progress." Major General Lansing H. Beach, Chief of Engineers, U. S. Army, on "The Relation of Adequate Highway Transport Facilities to National Defense," and Thomas H. McDonald, chief of the U. S. Bureau of Public Roads, on "The Highway Engineering and Highway Transport Fields and Their Need for Trained Men."

Major General Beach in his address, stressed the importance of goods roads to national defense. "The War Department, he stated, has prepared a map of a system of roads, covering the entire country, which it believes should be developed to meet the military needs of the nation. These roadways are deemed of prime importance to the national defense as well as of prime commercial importance. The Bureau of Public Roads is cooperating in the construction of the system so that in the course of time, the country will have a system of highways which will not only meet the demands of traffic, trade and commerce but will be admirable for use in military emergencies."

Mr. MacDonald outlined briefly the Federal-aid road-building program as administered by the Bureau of Public Roads, of which he is chief. The program he stated calls for the construction of approximately 180,000 miles of improved highways, and it will require from 15 to 20 years to build them. Last year he said about 10,000 miles was added to the mileage of completed highways but this year the mileage will be somewhat less.

"Highway construction has not kept pace," Mr. McDonald said, "with the general growth of the use of automobiles during the past eleven years. From 1910 to 1921 the number of motor vehicles increased 2,000 per cent; the increase in funds for road building was only 400 per cent. In the period from 1918 to 1921 the number of motor vehicles increased 700 percent and highway expenditures but 280 per cent."

Mr. Hanch, vice-president of the National Automobile Chamber of Commerce, also addressed the conference, he spoke of the increase in the manufacture of motor vehicles. " In 1910," he said, "there were 600,000 automobiles in use. At the present time, there are in use, approximately, 10,000,500 automobiles in the United States—83 per cent of the entire number of automobiles in the world. Opportunity beckons to the properly educated engineer. The automotive industry has need for such men. At the present time, the industry is working on a plan which probably will be perfected in the next few months whereby through cooperation it can avail itself of the supply of engineers graduated from the various educational institutions as fast as they graduate."

Speakers at the afternoon session included T. R. Agg, Professor of Highway Engineering, Iowa State College of Agriculture and the Mechanic Arts, Ames. Iowa, and Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Michigan. Messrs. Agg and Blanchard told of the trend of education for highway engineering and highway transport in the United States, and of the work yet to be done in meeting the demands of industry and the Federal and State programs for highway construction. The same subject, with respect to Canada, was discussed by A. W. Campbell, Commissioner of Highways, Ottawa, Canada.

PRESIDENT HARDING'S GREETINGS TO SECOND NATIONAL CONFERENCE ON HIGHWAY EDUCATION

"I have to thank you for the invitation to attend and address the national conference on education for highway engineering and highway transport. The subject is one in which I have long maintained a most lively interest and an examination of the program convinces me that this convention will be of very great usefulness.

"The whole program of transportation—in all its phases it must be regarded as that of a single problem, presenting a great many aspects—is among the most pressing and difficult that the entire world is facing at present. As you and your associates are probably much better aware than most other people, the transport facilities of the whole world, whether by rail or by water, or whether represented by the great network of public highways, have been confronted with a most difficult situation for a number of years. It is one which demands the very best and wisest treatment from the standpoint of both the technical and economic and financial authorities.

"We are all agreed that the country needs good roads and more of them, but we also have been brought to realize that they are not to be had without very great expense. Your organization is one of those particularly well equipped to deal with the industrial and technical side, as well as the financial aspects of this problem and I most earnestly hope that your Washington convention will produce some useful illumination of the problem."

Other speakers during the afternoon were C. J. Tilden, Chairman, Division of Engineering, Yale University, and Lewis W. McIntyre, Assistant Professor of Civil Engineering, University of Pittsburgh.

Research in highway engineering and highway transport was urged by Dr. W. K. Hatt, director of the advisory board on highway research of the National Research Council. Dr. Hatt pointed out that very few problems in highway engineering could be approached with any considerable number of determined facts. He urged action by engineering colleges to develop plans for research work.

Highway finance was the subject of an important paper by A. J. Brosseau, U. S. Chamber of Commerce. Construction of American highways, now approaching an annual cost of one billiion dollars, is in pressing need of a definite financial policy which should be worked out with the least possible delay, stated Mr. Brosseau. He offered the following suggestions looking toward working out such a policy.

"First: The preparation of a construction budget by every state, estimating the cost of the primary and secondary roads to be built, year by year, for the next ten years.

"Second: That based upon the stage of development of that program at this time, the cost of construction—all or part—shall be met by bond issues, except in those states where the construction program is practically complete.

"Third: That a budget of current operating costs be set up to defray interest on bonds, amortization charges, and maintenance. The amount necessary to pay interest and amortization should be included in the general tax levy. The cost of maintenance should be assessed against the user.

"Fourth: That all expenditures should be under the control of the state highway departments.

"Fifth: That regulatory powers should be flexible as possible and lodged only within the state highway department, to be administered in accordance with the needs of the public.

"Where state highway bond issues are necessary," Mr. Brosseau said, "they might be issued for as long a period as fifty years." Mr. Brosseau suggested that interest and sinking fund charges with respect to the bond issues could be paid from general taxation and that the cost of maintaining the highways should be charged against traffic.

A. W. Campbell, Commissioner of Highways for Canada, one of the delegates representing fourteen foreign nations at the conference, delivered an address in which he summarized the Canadian highway policy and outlined the technical requirements expected in the dominion of its train highway engineers. Among the nations represented by delegates at the conference were France, Italy, Austria, Germany, Czecho Slovakia, Finland, Denmark, Japan, Peru, Uraguay, Cuba, Mexico and Costa Rica.

A fascinating problem of mammouth proportions calls to the highway engineer today, in the opinion of C. J. Galpin. Economist in Charge of Farm Population and Rural Life, U. S. Department of Agriculture. Mr. Galpin pointed out that urban population in America had increased to the point where 287 cities of 25,000 inhabitants or more now contain nearly 40,000,000 of our population.

"The highway engineer is sorely needed at this moment, the engineer with daring imagination," Mr. Galpin said, "to help scatter the dwelling-houses and residence facilities of every one of these 287 cities far and wide into the out-lying open country and thus in some appreciable degree to de-house, de-home and de-residence our congested American cities. Automotive traffic in city streets is driving into our consciousness day by day the crime of rearing and housing our race in business areas, manufacturing districts, and the crowded streets of motor transport in our American cities.

"A large factor in decentralizing city homes is the transportation problem; and greater hope now arises in the humanitarian heart than ever before as one sees the new transport uses of the American highway. I would like to challenge the genius of highway engineers to help change this urban situation in the interest of the American home."

Cooperation With the Railroads

At the final session, W. H. Lyford of Chicago, Vice-President of the Chicago and Eastern Illinois Railway, spoke on "Cooperation versus Competition between Motor Truck and Railroad Transportation."

The Railroads, of the United States said Mr. Lyford might well consider the advisability of establishing auxiliary trucking systems in the chief cities of the United States to supplement existing railroad Transportation." The establishment of such trucking systems, Mr. Lyford stated should not be mandatory. It was his opinion, however, that the railroads probably would find it not only a great convenience, but profitable. Some cities already enjoy them. The truck should be used, he thought, to collect and deliver freight to and from the central terminal.

"If that is done," Mr. Lyford said, "I believe the railroad companies will find that they can dispense, to a large extent, with the costly terminal buildings now in use. These terminal buildings are virtually great warehouses. There would have to be terminal buildings, of course, but they could be much less expensive and constructed on a much more economical scale where freight could be collected and delivered promptly instead of lying over in virtual storage."

Many roads, Mr. Lyford believes, are operating unprofitable branch lines—mostly short stretches of roads whose existence is hardly justified by the volume of freight traffic they furnish. He thought that the railroads would find it profitable to discontinue the operation of these lines. so far as freight traffic is concerned, in many instances, and make deliveries and collections of freight by motor truck instead. The motor truck, in his opinion, is the freight car's chief aid and ally.

Mr. Lyford's address was the only set speech of the concluding session of the conference. The remainder of the forenoon session and the brief afternoon session were devoted to receiving and considering reports of the eleven educational committees. Among the chief of these was the report of C. J. Hughes, Dean of the Harvard Engineering School, Harvard University, Cambridge, Mass., chairman of the committee on teaching highway traffic regulation and safety. Dean Hughes submitted a report on "Whom to teach; What to teach; And how to teach it" in the nation's colleges and universities numbering highway engineering among their courses.

"Instruction in this course should be given only to those who will design, construct and maintain highways or motor vehicles," he said. "Those who will operate motor vehicles and those whose business it will be to make and enforce highway regulations.

"We should teach them the proper designing of highways and of automobiles—passenger cars and trucks—from the standpoint of traffic regulation and safety. They should be taught the proper method of designing signs, signal lights for vehicles and traffic guidance and other devices. One of the most important things we could possibly teach them is the regulation of traffic for efficiency and safety."

COLONEL WM. D. UHLER DIES

Pennsylvania's Highway Engineer Stricken With Apoplexy at Harrisburg

Col. Wm. D. Uhler, State Highway Engineer of Pennsylvania, was stricken with apoplexy at his home in Harrisburg on Monday evening October 23, and passed away Friday morning, October 27.

Colonel Uhler's sudden death comes as a shock to his friends and is a distinct loss to the good roads movement throughout the United States. He was an engineer of high attainment and rendered invaluable service not only to the people he served in his own State, but to the country at large in the high standards which he set in modern highway construction.

Colonel Uhler was born at Nazareth, Pa., Nov. 8, 1872, and began engineering work in 1890 as rodman and instrumentman on the Lehigh Valley R. R. For the next 14 years he was engaged principally in railway work with the Lehigh Valley, and the Maryland & Pennsylvania.

His entrance into the highway field dated from 1904, following a period of six months at the U .S. Naval Academy as inspector in charge of quay-wall construction. His first highway assignment was as road engineer for Caroline County, Md., a position from which he was promoted four years later to be engineer in charge of maintenance for the Maryland State Roads Commission. In this post he continued until 1912 when he resigned to join the staff of the Bureau of Highways of Philadelphia as principal assistant engineer.

When Samuel D. Foster resigned as chief engineer of the Pennsylvania State Highway Department, Governor Brumbaugh selected Colonel Uhler as his successor, effective April 7, 1915. He had been the engineering head of the Pennsylvania State Highway Department from that time until his death.

Colonel Uhler has taken an active part in engineering society affairs, particularly as they related to road work. He is a past-president of the American Association of State Highway Officials and was a candidate, this year, for president of the American Road Builders' Association.

HIGHWAY PROJECTS BACKED BY HUGE SUMS

Half of the Total $1,071,506,981 Debt of All States Has Been Incurred for These Purposes

More than a third of the $1,071,506,981.28, which is the total of the outstanding bonded indebtedness of all the states, has been incurred for highway survey of state debts and securities just completed by The Bank of America, New York.

The construction of highways and bridges is by far the leading single purpose for which the oustanding debts were incurred. The Bank of America statistics show, the total of $367,687,100 in highway bonds representing 34.3 per cent. of the entire indebtedness of the states. These figures are further significant when it is remembered that the development of state highway systems is comparatively recent and that a large proportion of these sums has been doubled by Federal aid, and yet for all this highway development vital to our life and commerce the per capita state debt is only about three and a half dollars.

Among the noteworthy highway systems financed by large bond issues now outstanding are those of California ($55,000,000), New York ($100,000,000), Oregon ($31,700,000), and Pensylvania ($50,000,000). Five other states, Illinois, Maryland, Massachusetts, Michigan and West Virginia, have bonds for more than ten million dollars issued for highway purposes.

SEVEN YEARS OF ROAD PROGRESS IN WYOMING

The last seven years have been a period of great road development in the state of Wyoming. From 1914 to 1921 the total road mileage has increased from 14,797 miles to 46,526 miles, this being in strong contrast to the majority of states which have made great progress in road improvement but without any appreciable change in total mileage.

During the seven-year period the mileage of improved road has increased from 1724 miles to 5,867 miles. The mileage of road is classified as follows:

Unimproved	39,373 mi.
Graded and drained ..	6,715 mi.
Gravel, short, shale ..	413 mi.
Hard surfaced	27 mi.

In 1921 the total road revenue of Wyoming, including Federal-aid funds, amounted to approximately $5,408,000 and expenditures $4,725,000. During the year 1673 miles of improved road were completed in the state and considerable maintenance work done. Federal aid is playing a considerable part in road advancement in Wyoming, as shown by the fact that on August 31, 474 miles of Federal-aid road had been completed, 421 miles were either under construction or approved for construction, and nearly $800,000 was available for new projects.

The state sytem of over 3,000 miles of road to be built with Federal aid and which will form a part of the Federal-aid highway system will be definitely settled upon within a short time.

Pueblo Commerce Club of Colorado Asks Removal of Signs

A resolution has been passed by the directors of the Pueblo Commerce Club of Colorado asking the Highway Advisory Board to exercise its powers to remove and prevent the further erection of guide signs on the state highways.

Complaint is made that the advertising signs are so numerous now that they have become a menace to safety of the traveler. Oftentimes the signs mar the beauty of the natural scenery.

Under the Highway Act of 1921 the Advisory Board is given power to remove all objectionable signs from the State Highways. Also the board is given power to regulate the design of all sign-boards along the highways.

CALENDAR OF COMING MEETINGS

Federated American Engineering Societies, Washington, D. C.; annual meeting Washington, Jan. 11-22, 1923.

American Roadbuilders Association, New York City; Annual Convention, Chicago, Jan. 15-18, 1923.

American Society of Civil Engineers, New York City; Annual meeting, New York City, Jan. 17 and 18, 1923.

American Concrete Institute, Detroit; annual convention, Cincinnati, Jan. 22-26, 1923.

Associated General Contractors of America, Washington, D. C.; annual meeting, Los Angeles, Jan. 30-Feb. 3, 1923.

Four States to Vote on Highway Bonds

Voters in four states, Colorado, Kentucky, Georgia and New Jersey will cast ballots on highway bond measures at the coming fall elections. In the first three states named the bonds are to be retired from automobile license tax, gasoline tax or by a 3-cent road tax.

In Kentucky the issue is for $15,000,000 for the improvement and maintenance of roads for the next three years. The bill which passed the Senate by a vote of 63 to 34 provides that the automobile license fees and gasoline tax shall be used to pay the interest and retire the bonds in thirty years.

In Georgia the measure calls for $75,000,000 to be issued for road building and maintenance purposes. The bonds will be retired through the automobile and gasoline tax.

In Colorado the measure calls for the issuance of $6,000,000 of highway bonds at the rate of $1,500,000 per year for 4 years to be used to meet Federal Aid appropriations.

The bonds will be retired from the one-half of the automobile license fees which now go into the State Highway Fund. The counties share of the automobile licenses will not be touched and will be distributed to the counties for road work as heretofore.

The highway future of New Jersey will depend to a considerable extent upon the action taken by the motorists and other voters of that state on November 7th in connection with the proposiion to endorse a $40,000,000 bond issue for road construction and maintenance.

Advocates of the measure say that should it fail of the majority of votes, the result will mean practically a five-year holiday in highway development within New Jersey. Of the proposed issue it is planned to use $30,000,000 for road construction and $10,000,000 for bridges. The N. M. A. clubs of New Jersey are backing the bond issue.

IOWA HIGHWAY WORK CONTINUES UPWARD TREND

A total of 3,194,922 sq. yd. of pavement have been placed under contract in Iowa this year. Of this yardage, which includes both resurface and new work, 70 per cent. is concrete. Of the municipal contracts for new work concrete represents 47 per cent.

A recent survey of the uncompleted yardage on both the highway and municipal work, shows that on September 16 there were 845,327 sq. yds. of uncompleted highway paving and 511,673 sq. yds. of municipal paving. The large yardage of uncompleted highway work is increased by the fact that on September 8, Scott County awarded a contrac. covering 242,718 sq. yds. on which there will be very little, if any, yardage completed this year. Twenty-five miles of concrete road and over 200,000 sq. yds. of municipal work were put in during the past month.

There will be considerable yardage on both highway and municipal work carried over into 1923, principally due to inability to secure materials on account of the railroad strike. The outlook for considerable yardage on highway and municipal work also looks very promising. Several counties have good sized projects under consideration and it is anticipated that bids will be asked on some of the work between now and January 1, 1923.

NEBRASKA DEPARTENT OF PUBLIC WORKS ADVOCATES SEPARATION OF STATE AND COUNTY ROAD CONTROL

A legislative committee report published by the Nebraska Department of Public Works generally discredits county construction of highways. The lack of records and proper accounts found in many of the counties is said to be deplorable, and discredits all costs per mile. The committee recommends that:

1. Complete segregation be made of state and federal-aid roads from the county roads, both as to construction and maintenance, the complete responsibility for the construction and continued maintenance of state and federal highway system being in the Department of Public Works, and a like responsibility for county roads in the County Board. This suggestion will fix the responsibility, eliminate the necessity of co-operation between so many branches of the government, and centralize the authority where it may be exercised.

2. Every county shall have a county highway engineer with a longer term than two years of office, probably four years. There should be definite qualifications fixed before an engineer can become eligible to this office. It is very difficult for the county boards to ascertain in advance whether they are securing competent men and experiments are costly.

3. The highway engineer should be given ample authority in matters pertaining to the construction and maintenance of the county roads, and be charged with the responsibility therefor. We believe that he should have absolute authority of the proper construction and maintenance of all county roads. This would contemplate the removal of authority from the township board, but it would result in a more centralized responsibility and opportunity.

4. That each county should lay out a system of highways for itself just as the state laid out the system of state highways, and that all work done by the county should be done so as to fit into this plan of operation. The piecemeal work which has been done in many places is largely wasted.

5. We believe that beyond a doubt some uniform standard of accounting for expenditure should be required of every county in the state. The present law we regard as ideal, but if it is too cumbersome then it should be simplified, but in all events the county should keep such a uniform accounting system. With the ex penditures of such large sums of money, this is highly important.

6. We believe that it would be a benefit to the state if the counties were required to submit quarterly reports of their expenditures relating to highway matters to smoe central agency, not for the purpose of auditing them or burdening them, but in order that there may be centralized and tabulated information available as to the mileage and costs, and the general condition of the roads in every county in the state. It seems to us that this information is necessary to intelligently deal with the highway problems of the future.

Personal Mention

Harry D. Elliott, formerly with S. S. Boggs, county engineer of Warsaw County, Ind., is now one of the testing engineers with the Illinois State Highway Commission.

J. McLane Tate, until recently a project engineer with the New Mexico State Highway Commission, is now connected with the Wilkie Woodward Co., of Los Angeles, Cal., civil and landscape engineers. Mr. Tate's position is that of assistant engineer.

R. W. Kinnally, formerly resident engineer of the South Dakota Highway Commission, has resigned and joined the contracting firm of W. J. Cole at Huron, South Dakota.

Stewart Blackmann, formerly an assistant engineer in the Massachusetts Highway Commission, has become associated with the Kansas City Power & Light Co. as engineer and draftsman.

O. W. Gatchell, formerly assistant engineer with the Ohio State Highway Department, is now with Frank T. Miller, consulting engineer, of Greensboro, North Carolina.

H. M. Neighbour, until recently resident engineer on concrete paving, El Paso Co., Tex., has now become field man on concrete bridge work for the Maricopa (Ariz.) County Highway Commission. He is stationed at Phoenix.

Abe Wolman has been elected chief engineer of the Maryland State Department of Health to succeed Robert B. Morse, resigned. He will continue as lecturer in sanitary engineering in the Johns Hopkins University School of Hygiene and Public Health, and as editor of the Journal of the American Water Works Association.

F. W. Buhrmeister, formerly junior highway engineer with the Illinois Visiion of Highways, is now with the American Bridge Company as detailer.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor

E. W. TREE, Managing Editor

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TABLE OF CONTENTS

The Trend of Highway Transport Education in the United States 163

By Arthur H. Blanchard

Graduate Work in Highway Engineering 165

Report of a Committee of the Highway Education Board Presented to the Second National Conference on Education for Highway Engineering and Highway Transport

Educating the Public to Highway Constuction Needs 166

By A. R. Hirst

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

- American Road Builders' Association Announce Committees 168
- Link Better Roads with Armistice Day . . 168
- Indiana to Open Bids for 1923 Program . . 168
- Meeting of Committee on Structural Design of Roads 169
- Calendar of Coming Meetings 169
- Nevada State Highway Department Making Checks on Overloaded Trucks 169
- Iron Range Highway Formally Opened . . . 169
- Pennsylvania to Replace All Narrow Bridges With New 169
- Banking Highways at Curves 170
- Illinois Specifications for 1923 170
- Engineers Investigate "Black Base" Pavements . 170
- Tremendous Road Program in the Southern States 170
- Montanans Act to Save Federal Road Fund . . 170
- Proposed Bridge Over Mississippi to Cost $900,000 170
- Wisconsin Counties Ask State for Continued Road Aid 170
- Farmers Get Fire Protection Through Good Roads 170

Personal Mention 170

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Above: Du Bois St., maintained with "Tarvia-B" since 1916.

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>
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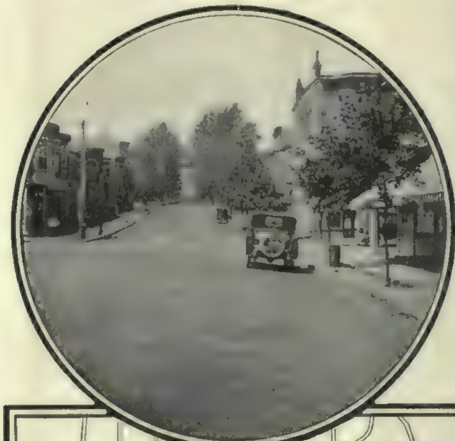

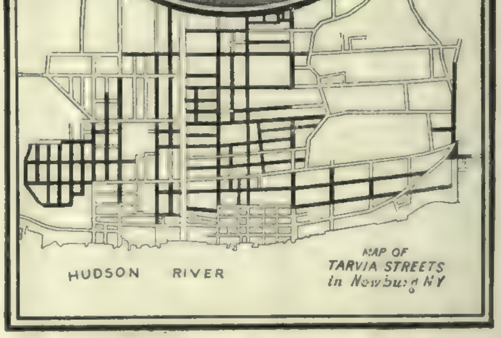

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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The Trend of Highway Transport Education in the United States

By ARTHUR H. BLANCHARD

Professor of Highway Engineering and Highway Transport, University of Michigan.

WHAT is included in highway transport education? I conceive that highway transport education should cover the fundamentals of the science, art, economics and business of the transportation of passengers and commodities over highways. Courses in this field will be taken by men looking forward to the profession of highway transport engineering, the motor vehicle industry, and the business of traffic management and highway transport.

In the opinion of some, highway transport may not be considered as belonging to the field of technical training and education. On sober thought, however, it will be seen that this branch of knowledge comes well within the classic definition of engineering embodied in the Royal Charter of the Institution of Civil Engineers of Great Britain, which, in part, is as follows: "The art of directing the great sources of power in nature for the use and convenience of man as the means of production and of traffic in states both for external and internal trade."

From the standpoint of highway transport business, courses in this field will be taken by men who desire to efficiently equip themselves for the positions of business administrators, dealers, salesmen and advertisers in the motor vehicle industry, and executive operators, traffic managers, motor truck fleet managers, and dispatchers in the commercial field of highway transport, and in the closely related fields of railway and waterway transport.

The Demand for Trained Men

What is the demand for highway transport engineers and men equipped for highway transport business? In May, 1920, the First National Conference on Highway Engineering Transport Education held in Washington, D. C., unanimously adopted the conclusion that 4000 men should be trained in highway transport each year in universities for the positions heretofore enumerated. Many have misinterpreted the meaning of this conclusion. Emphasis should be placed on the words ***should be trained.*** The representative committee framing this conclusion had in mind the economic and efficient utilization of highway transport in the transportation system of the United States. They did not say that there was an immediate call for 4000 trained men each year, but they did imply that the country would be benefited by having 4000 men trained each year and their services utilized in the field of highway transport.

When is the present situation in regard to the demand for highway transport engineers and men trained in the business of highway transport? While it is true that the University of Michigan, which first instituted courses in highway transport and is in the heart of the motor vehicle industry, has no difficulty in placing its men in the highway transport field, the number of well-paid positions available in this field at the present time is comparatively small. Why does this condition exist? The answer is simple. The potential users of men trained in highway transport are not educated to the value of the services of such men.

Allow me to respectfully suggest that the Highway Education Board devote at least as much time to the spread of propaganda among potential users of men trained in highway transport as in encouraging the universities throughout the United States to establish courses in highway transport. A herculean task must be consummated in this field if we are to see highway transport take its proper economic place in the transportation system of America.

A Lack of Men With Vision

Many highway departments are not properly designing the highways for even immediate future traffic because their personnel does not include men who have had a proper training in highway transport to have a vision and adequate background which will enable them to diagnose the probable development of traffic on a given highway, or, in other words, to make the prerequisite of economic highway design, a highway transport survey, which embodies all investigations in the field and office which are necessary to efficiently estimate the probable amount, character and effects of the future traffic which will use a given highway during the lives of its several component parts.

The establishment of a sound transport business is based on the results of an exhaustive transport survey. Why should not the same policy be followed when the economic investment of millions of dollars in highway improvements is at stake? In order that highway transport surveys should be properly conducted and adequate provision be made for the economic design, construction and maintenance of highways, each state highway department

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Presented at the Second National Conference on Education for Highway Engineering and Highway Transport held in Washington, D. C., October 26, 27 and 28, 1922.

should create a highway transport division. The duties of this division would be to deal with all matters pertaining to traffic and transportation which affect the economic design and maintenance of highways and their efficient use by pedestrians and all classes of vehicles. One of the most important functions of such a division would be to make highway transport surveys as preliminary to the design and redesign of state highways, the determination of efficient methods of maintenance, and the formulation of recommendations pertaining to efficient traffic and transport regulations.

Men assigned to a highway transport division should be experienced highway engineers who have or are rapidly acquiring a knowledge of the following subjects: highway transport economics, legislation, surveys and methods; highway transport management, including delivery systems, scheduling and routing, traffic regulations; interrelationship of highway, railway and waterway transport; port, terminal and warehouse facilities; and the fundamentals of the mechanism and operation of automobiles, motor trucks, tractors and trailers.

In order to secure and retain the services of engineers qualified to occupy responsible positions in a highway transport division, it will be necessary for state highway departments to pay salaries ranging from $3600 to $10,000. Not only will the economic law of demand and supply in the highway engineering field necessitate the payment of proper salaries to engineers trained and experienced in highway transport, but highway departments will be forced to compete with the commercial demand for the services of such men.

The Relation of the Motor Truck Manufacturer

Motor truck manufacturers' organizations are in a chaotic condition from the standpoint of the proper utilization of men trained in highway transport. Why? In general, they have followed in the obliterated footsteps of companies manufacturing highway machinery and materials. The latter companies orginially established departments which were advertised to give unbiased consulting service to their customers. Motor-truck companies established a few years ago highway transport engineering departments and advertised to make a complete highway transport survey covering the requirements of a prospective user of motor trucks and to give unbiased advice pertaining to the purchase of equipment. What was the result? In the first place, it was found impracticable to divorce unbiased opinion from the commercial interests of the organization represented and soon prospective customers began to realize this self-evident act. Second, disastrous conflict arose between the highway transport engineering department and the sales organization, a natural result to anyone familiar with the interrelationship existing between the activities of such departments. What was the final outcome in the case of companies manufacturing highway materials and machinery? The natural logical conclusion was reached that the sales organization should contain men trained in the fundamentals of highway engineering practice and the efficient and economic utilization of the machinery or materials manufactured. The results have been beneficial not only from the standpoint of the commercial organizations concerned but also from the standpoint of the general highway engineering profession and the public, which ultimately is benefited by increased efficiency. All are familiar with the efficient services rendered along these lines by such commercial organizations as The Asphalt Association, The Barrett Company, The Granite Block Manufacturers' Association, The Jennison-Wright Company, The National Paving Brick Manufacturers' Association, The Portland Cement Association, The Texas Company and many others. I predict that in the near future the motor truck manufacturers of this country will see the light and follow in the footsteps of the closely related companies who have already passed through the transition stage. Concretely stated, the sales organizations of motor truck, tractor and trailer companies should be composed of men trained in the fundamentals of highway transport and the efficient use of the equipment manufactured by the company they represent.

Why Highway Transport Companies Fail

Failures of highway transport enterprises are occurring every day due to a lack of knowledge of the fundamentals of the economics, science and art of highway transport. It is reported that 90 per cent of all highway transport companies doing business with New York City as a center fail within 3 years after entering this field. While 50 per cent may fail due to cut-throat competition by fly-by-night companies, it is conservatively estimated that at least 50 per cent fail because of lack of knowledge of the A B C's of efficient highway transport business methods, cost accounting, management, and the operation and maintenance of equipment. The Highway Education Board has a big task before it in bringing to the attention of groups of business men or capitalists, operators and prospective operators of highway transport, the necessity of having connected with their operating organizations men who are thoroughly trained in the methods of highway transport, the interrelationship of highway, railway and waterway transport cost and record systems and the principles of highway transport management, together, of course, with a knowledge of the mechanism, operation and maintenance of motor trucks, tractors and trailers.

We find a satisfactory status relative to the development of highway transport education in the universities throughout the United States. In some institutions, the logical development occurs by the men having charge of highway engineering courses in the related field of highway transport. In other institutions, such courses are offered by the department of economics or business administration. If these departments are to efficiently teach highway transport, the instructors must have a knowledge of the fundamentals of the economics and science of highway engineering and practical highway transport. It is expected that notable developments will take place along these lines, especially when authoritative texts are available. We have a development in the main of undergraduate instruction in the fundamentals of highway transport. In this connection, allow me to strongly emphasize a recommendation which I have made at the University of Michigan that all engineers should be required to take, as a part of their curricula, a fundamental course in "Transportation" which would cover the economics of the ultization and operation of highway, railway and waterway transport.

Naturally, developments in the graduate field have been slow, due first to a lack of demand by students for such courses; second because there are few instructors who feel capable of giving graduate instruction in this field; and third, due to a lack of the necessary financial support by institutional administrators.

As soon as the demand from potential users develops, it will be necessary to materially speed up the training of mature men as well as college students in the fundamentals of highway transport. It is my belief that the graduate short period course offers the most efficient method of training mature men who may be connected with motor truck or trailer manufacturers' promotion and sales organizations; traffic departments of plants, factories, wholesale and retail stores, steam and electric railroads, and waterway transportation companies; highway transport enterprises; and state, county or municipal highway departments. Such courses in the field of highway engineering and highway transport are developing rapidly at the university, which I have the honor to represent. Eighteen of these courses are given in periods of two weeks each during the months from December to March inclusive. Each course consists of 30 lectures, or the equivalent thereof, and counts as 2 hours credit towards the total of 24 hours required for the master's degree. Persons of mature age, who do not hold collegiate or technical degrees, may register for these courses as special students, not candidates for a degree. In the first year, 1919-1920, when such courses were offered at the University of Michigan, the attendance was 29. In 1920-1921 the attendance increased to 45, while in 1921-1922, 94 men were registered in these courses, the average age of the men being 27 years, ranging from 22 to 54 years. They came from all over the United States, and some from foreign countries. They represented universities; state, county and municipal highway departments; consulting engineers' offices; contractors' organizations; companies manufacturing motor trucks, highway machinery and materials; and from the field of highway transport business. About 50 per cent of these men were graduate engineers registered in the graduate school for the master's degree, 16 master's degrees being awarded in June, 1922, to men with a major subject in highway engineering or highway transport. The other 50 per cent were mature men in practice who had not had a college training. It should be stated that all men are on an equal footing in these graduate courses and take an equal part in the discussions of the many subjects considered.

In this connection, I wish to reiterate my recommendation at the 1920 Conference that at least 10 universities, located in different geographical sections of the United States, offer graduate short period courses covering the various phases of highway transport, if they are financially able to engage the proper personnel and provide sufficient equipment for carrying on graduate work in this field. It is earnestly hoped that this recommendation may be favorably considered by administrative bodies of some leading universities and that they will adopt the broad-visioned policies of Dr. Marion L. Burton, president of the University of Michigan, and the Board of Regents, who have provided adequate personnel and physical equipment for the efficient development of graduate instruction and research in highway engineering and highway transport as shown, first, by their action in establishing a chair of highway engineering and highway transport, and appointment of two assistant professors, a librarian of the Davis Library of Highway Engineering and Highway Transport, an instructor, and three assistants in highway engineering, and, second, in their assigning two floors of one wing, 65 ft. by 225 ft., of the new $750,000 engineering building to the division of highway engineering and highway transport.

Graduate Work in Highway Engineering

Report of a Committee of the Highway Education Board presented to the Second National Conference on Education for Highway Engineering and Highway Transport, held at Washington, D. C. October 26-28, 1922

The following report was presented to the Second National Conference on Education for Highway Engineering and Highway Transport which was held under the auspices of the Highway Education Board at Washington, D. C., on October 26, 27 and 28. *It was prepared by a committee consisting of H. C .Smith, Chairman; F. L. Bishop, A. H. Blanchard, G. M. Braune, C. D. Curtiss, W. K. Hatt, T. F. Hickerson, Prevost Hubbard, D. J. McComb, George H. Pride, E. W. Templin and Chas. M. Upham.*

IN formulating its report, the committee has had in mind the following fundamental principles governing graduate engineering work.

1. The courses should be designed to prepare students to render the service demanded by our social and industrial life.
2. The work should cover a field, beginning at that point where undergraduate work stops.
3. The time at which the work is given should be such that the largest number possible who desire such training can attend.
4. The curriculum should be well co-ordinated as a whole, yet it should be sufficiently flexible to allow students to make special investigations in subjects in which they are interested.
5. The results of any noteworthy investigations should be made available to other investigators and the public.

It is realized by the committee that the institution offering graduate work in highway engineering and highway transport in keeping with these principles is undertaking a task fraught with problems.

Although there is an overwhelming demand from the public for men trained in highway transport, the industry is undergoing such radical changes that the demand is not fully crystalized. The graduate work therefore must be general in scope and fundamental in character.

Highway engineering and highway transport are attracting individuals from all fields. Some are literary graduates who have no engineering training except perhaps pure science, many are graduates in civil engineering who have had no training in highway transport but usually have come in contact with highway engineering to a limited degree; others are engineering graduates who have not even touched upon highway engineering, while some few are graduate highway engineers who perhaps have had more or less experience in the practice of that profession. Graduate work in highway engineering and highway transport, therefore, should deal with the fundamentals, as well as advanced professional practice.

To have courses given during the regular collegiate year only would mean that those attending would have to leave their work early in the fall, which is usually the busiest season. Although it is desirable to have regular collegiate courses for those who can give up the time to attend, arrangements should be made also to accommodate those who cannot so arrange their time.

Students from active work may desire special instruction in one particular phase of the industry and although he may not be able to attend a course running throughout a semester, he should be able to make the desired specialization.

In view of the foregoing facts, your committee wishes to present the following conclusions for your consideratin:

1. Fundamental courses in highway engineering and highway transport which are open for students to take for graduate credit should be offered in the regular semester courses.
2. This same work and further specialization should be given in a series of two or three-week courses during which time all effort is concentrated on the subject at hand. Hours credit should be given according to the class-room time spent in each period or on each course.
3. The sequence of courses should be properly arranged so that the subject as a whole is covered logically, and should be arranged in related series so that a series of related subjects can be taken consecutively without any idle time.
4. A complete collection of text-book and periodical literature on highway engineering and highway transport should be available and outside lectures should be secured from men who are actively engaged in the industry and who are recognized authorities in the phase of the work upon which they are to lecture.
5. The series of courses offered should embrace the following subjects:
   - HIGHWAY ENGINEERING
     - Highway Engineering Economics, Financing, Management, Organization and Personnel.
     - Highway Engineering Theory and Design.
     - Highway Specifications, Contracts, Inspection and Jurisprudence.
     - Grading Machinery anl Operations, and Earth and Sand-Clay Roads.
     - Gravel and Broken Stone Roads, Dust Prevention and Bituminous Surfaces.
     - Brick, Cement-Concrete, Stone Block and Wood Block Pavements.
     - Bituminous Macadam, Bituminous Concrete and Sheet-Asphalt Pavements.
     - Highway Materials: Production, Advanced Tests and Research.
     - Highway Structures.
     - Highway Engineering Seminar.
   - HIGHWAY TRANSPORT
     - Interrelationship of Highway, Railway and Waterway Transport.
     - American and English Highway Transport Methods.
     - Highway Transport Economics and Surveys.
     - Highway Transport Legislation and Traffic Regulations.
     - Mechanism, Operation and Maintenance of Motor Trucks, Tractors and Trailers.
     - Highway Transport Management: Administration, Organization and Personnel.
     - Highway Transport Costs and Record Systems.
     - Highway Transport Seminar.
6. There should be provided the opportunity to take certain courses to be arranged to meet the needs of any group of students who desire to make worthy investigations in any particular field.
7. State, county and municipal highway departments should cooperate with educational institutions in providing for graduate students, training and experience in highway engineering and the operation and maintenance of motor trucks.
8. Fellowships should be provided for high grade graduate students by individuals, companies, and state highway departments.

Educating the Public to Highway Construction Needs

By A. R. HIRST

State Highway Engineer of Wisconsin.

POSSIBLY a good many of us, working in our small individual fields of highway work, are a little apt to lose sight of the fact that during these last few years and in the years to come we are going to live through one of the greatest romances of all engineering history. We are too apt to localize our viewpoint within our especial field in this work, but it is true that in these American states we are undertaking the greatest engineering enterprise in the history of the world in this attempt to build a highway system.

The railroads in the five years between 1879 and 1884 built several thousand miles of railroad, but they did not build within that period one-quarter of the highway mileage that we are building during the present five years and they did not spend one-fourth of the money. They paid engineering talent quite well in those days. They turned them loose on the construction, and, in general, the construction was performed as a straightforward engineering matter

Now the best paid highway organizations in the United States, considering relative responsibilities, are some of the county highway organizations. The next best, or I should say, worst, paid are the State organizations, and the very worst paid are the Federal men. Our good friend, the Director of the Bureau of Public Roads, a wonderful man and engineer, receives a munificent compensation of $6,000 a year. We must by every means in our power fight for progress in this matter. We must fight for the proper standards of organization and efficiency. We must concentrate upon this and ding at it insistently because, if we are going to spend at the rate of $700,000,000 a year and more for highways, the organizations which spend it cannot be too efficient, and efficient is just another word for well-paid organizations.

The politicians in America have played with the highway game for several years. Some of them have found that it is a very expensive thing and a dangerous thing to play with, and those states are clearing up. But, until the governors of all the states learn that here is one thing which they cannot afford to meddle with in a political way, the American people will continue to have very expensive lessons. As a matter of fact, it is astounding that they have not gotten worse than they have so far.

The state legislatures have not awakened to the fact that this is about the sole public enterprise in which states and counties are in a competitive field. They are so used to having as officials men who could not make a

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Abstracts from Western Contractor.

living in any other way, that it has gone down the line that a man who is employed by the public must necessarily be a loafer, a grafter or an incompetent.

We must teach and preach that this highway enterprise is entirely different from the ordinary run of public offices, which are usually held in America either by men who have been or by men who hope to be. We are trying to build up organizations which will be a permanent field of service for the life-work of young men; and, if we are to attract the best young men, we must offer a proper environment in which to work.

In talking highways we are too apt to think of highways in terms of specific details. The romance of the highway game, lies in the fact that we are seeing develop before our eyes the greatest growth of transportation ever known in the history of the world, and we are supposed to take care of it from day to day and from year to year. We have in Wisconsin approximately 350,000 motor vehicles. They travel over our highways 1,250,000,000 miles a year. If we can save them 1 cent a mile, it would mean a $12,500,000 a year saving to this traffic.

Serve Traffic Now

We must build highways as fast as we can get our taxpayers to pay for them. We must recognize the fact that highway traffic is the thing to be served and that the details as to whether we build 1,000 or 3,000 miles each year is rather immaterial. The thing to get hold of is the mattter of serving traffic, not five years from now but right now.

We simply have got to sell this romance of ours. We have got to convert the people from thinking of the thing merely as a matter of dollars and cents. There will be no complaint if we deliver to the people 100 cents on the dollar. Our highways do not come from a state highway department or from a university. They come from the legislature of the states. They come from the county boards in the various counties. There is the crux of the situation. There is where the money is provided and the laws made which make it possible for us to build roads, and there is where the conditions under which we are to operate are created.

If more engineers would turn their attention to this end of the game, the matter of the education of the public, the legislatures and the county boards, which after all reflect the desires and purposes of the people, and pay possibly a little less attention to the science and theory of construction, concentrating themselves upon this for the next three, four, or five or ten years and educating the public to an appreciation of this public work, we will get our results a good deal faster and easier. I am familiar with the highway results in America. I know what we are doing in the middle west and I had the pleasure of taking a trip through the Eastern States and I came back from that trip well satisfied that, after all, the American people have gotten pretty good value out of all they have spent for highways in the last five or ten years, whether the roads were built of gravel, macadam, concrete or brick. In general, they were giving all the service they could be expected to give and the American people will get out of them all they put into them and more.

We have too much worry about the millions of dollars that have been wasted. Very few of them have been wasted. Wisconsin, Minnesota and Michigan have built large mileages of low type roads, gravel and macadam, for which we have been criticized. In most cases we got those roads complete, including surfacing and culverts, for less than the grading and culvert work could be done for today. They had had these surfaces for all these years and they will make a good foundation for future work. They talk about some of our old concrete roads in Wayne County and Milwaukee County and others as having cracked badly. They are worth more now as a base for any other kind of pavement we may wish to put on than they cost ten years ago; they are not lost.

The most important thing, in my opinion, after the necessary education of public sentiment, is that we should consider the problem of proper locations of highways. If the States have lost anything in their highway investment, it has been because we have not looked far enough into the future. We have not located well enough.

Let us get into figures. A highway which carries 500 vehicles as a maximum a day in the summer season and drops off the rest of the year is a light traveled highway; but even on this highway one mile of extra distance costs travel over this road approximately 123,250 miles a year, and the cost of this extra traffic at 10 cents a mile for each mile is the interest at five per cent. on $246,500.

Take this matter of detours. The question is whether to put in a detour or accommodate traffic by building a temporary road or bridge. Taking the average summer road in Michigan or Wisconsin with 500 vehicles a day, a three mile extra detour means 1,500 miles a day. If the road is closed for 90 days, it means $13,500.

Those are the kind of figures we are dealing with. The cost of highway traffic is paid by millions of people. We have just exactly the same problem in taking care of this traffic that the railroad has in taking care of its traffic. We can lose just as much as they could by the unskillful handling of this traffic.

In my opinion, in many cases, rather than to use a bad detour, it would be much better to ditch the old right of way and build a new road parallel to it, and to let traffic use the old road while the construction of the new road is going on. It would cost the people less money.

Progress Always Draws Criticism

I made the statement at Omaha that the State highway department which was not being severly criticized because of its drastic relocations and treatment of distances, curves, and railroad crossings was failing in its duty as a State highway department. The Wisconsin department is severely criticized; the people think some of our plans are too drastic. But, for the 50 years between 1860 and 1910, the farmers and the towns of Wisconsin were so busy in unrelocating highways that we have had an awful time to catch up with them. It was the era of squaring fields and time after time, to the extent of dozens of miles, we have bought back from the farmer the old right-of-way on which the pioneers put the highway, which was later abandoned in order to square fields. What they took from the public for nothing, we are buying back and paying thousands of dollars for.

The location of gravel roads is not quite so important, but concrete roads cannot be located too well. There is no reason to believe that we are any more foresighted now than we were five years ago. I don't believe that any state highway department can get away with a program of highway location which is too drastic, because before they do they will be overturned. The art in this business of highway construction, maintenance and location is to get just as far as you can possibly go and get away with it. Sometimes some one goes too far and does not get away with it. The thing we want to look out for is that we are steering close to the rocks all the time in this matter of proper location and proper widths and proper types, because only in that way can we be sure that we are nearly right and that our successors will not criticize us for being blind to the probable development of traffic.

Current Events in the Field of Highway Engineering and Transport

AMERICAN ROAD BUILDERS' ASSOCIATION ANNOUNCE COMMITTEE FOR 1923 GOOD ROADS SHOW AND CONVENTION

Committees announced thus far in connection with the arrangements for the Thirteenth American Good Roads Congress and the Fourteenth National Good Roads Show to be held in Chicago, January 15th to 19th next, indicate that the American Road Builders' Association, under the auspices of which both events will be held, is going about the business this year in a most effective way. The committees are composed of the most active men identified with the good roads movement and the various road building industries. The personnel of the following committees was announced this week:

Convention and Show Committee—C. M. Upham, Raleigh, N. C., chairman; T. J. Wasser, Trenton, N. J.; S. F. Beatty, Chicago, Ill., and James H. MacDonald, New Haven, Conn.

Banquet Committee—J. R. Draney, New York City, chairman; J. F. McGurk, Chicago, Ill., vice chairman; I. J. Bransfield, Chicago, Ill.; A. J. Brehm, Cincinnati, O.; Frank B. Dunn, Connaut, O.; William Howe, Chicago, Ill.; W. H. Kershaw, New York City; Claude King, Wilkes-Barre, Pa.; H. R. Kasson, Chicago, Ill.; Fred Lucke, Chicago, Ill.; Ed. Middleton, Chicago, Ill.; Charles Matteer, Chicago, Ill.; Robert McKay, Chicago, Ill.; W. J. Malatesta, Chicago, Ill.; W. H. Malone, Chicago, Ill.; John P. McGarry, Chicago, Ill.; Grant Osborne, Chicago, Ill.; W. W. Platzer, Chicago, Ill.; H. A. Royer, Chicago, Ill.; A. C. Sullivan, Chicago, Ill.; John Sullivan, Chicago, Ill.; Dyer Sackley, Chicago, Ill.; Ernest Stocking, Chicago, Ill.; William Sinck, Chicago, Ill.; W. H. Stone, Baltimore, Md.; R. B. Tyler, Louisville, Ky.; M. E. White, Chicago, Ill.; Bertram H. Waite, New York City, and Roger Williams, Chicago, Ill.

Publicity Committee—S. T. Henry, New York City, chairman; J. E. Pennybacker, New York City; C. R. Ege, Chicago, Ill.; M. O. Eldridge, Washington, D. C., and R. E. Brooks, New York City.

Entertainment Committee — A. C. Cronkrite, Chicago, Ill., chairman; A. A. Ackley, Chicago, Ill.; James A. Alder, Chicago, Ill.; Charles J. Bennett, Hartford, Conn.; S. H. Bingham, Chicago, Ill.; F. P. Bowman, Chicago; J. P. Case, Chicago; R. B. Dickinson, Chicago; Thomas J. Hay, Chicago; J. L. Hecht, Chicago; U. J. Herrman, Chicago; G. E. Hillsman, Chicago, W. L. Hodgkins, Chicago; Samuel Irwin, Philadelphia; J. M. Kelly, Trenton, N. J.; E. J. Kilborn, Chicago; James Levy, Chicago; F. W. Lucke, Chicago; W. J. Malatesta, Chicago; J. J. McCarthy, Chicago; H. McKay, Chicago; E. L. Middleton, Chicago; A. C. O'Laughlin, Chicago; Grant Osborne, Chicago; R. B. Randall, Chicago; F. A. Renwick, Newark, N. J.; F. W. Renwick, Chicago; Henry Royer, Chicago; J. B. Sackley, Chicago; J. J. Sullivan, Chicago; L. N. Whitcraft, New York City; M. E. White, Chicago; F. V. Widger, Chicago, and M. J. Faherty, Chicago.

Reception and Hotel Committee (Honorary Members)—M. J. Faherty, Chicago; Charles C. Fitzmorris, Chicago; Clifford Older, Springfield, Ill.; C. R. Miller, Springfield, Ill.; George A. Quinlan, Chicago; Daniel Ryan, Chicago; Edward E. Gore, Chicago; John Bowman, Chicago; W. W. Baird, Chicago; Watson F. Blair, Chicago; W. E. Humphrey, Chicago; Homer Neize, Chicago; James C. Jeffrey, Chicago; A. M. Cornell, Chicago; Julius L. Hecht, Chicago; R. I. Randolph, Chicago; A. J. Hammond, Chicago; W. F. Lodge, Monticello, Ill.; Eugene R. Pike, Chicago; Christian C. Wiehe, Chicago; Si Mayer, Chicago; Herman Mack, Chicago; W. Frank McClure, Chicago; Charles M. Hayes, Chicago; (Active Members): R. F. Kelker, Chicago; K. A. McGuire, Chicago; Charles Wallace, Chicago; Harry A. W. H. Myers, Chicago; Fred W. Hansen, Chicago; William G. Coats, Chicago; F. W. Lucke, Chicago; C. E. Matteer, Chicago; and J. E. Black, Chicago.

Registration Committee—Lewis S. Louer, Chicago, chairman; Ezra W. Clark, Chicago, and Louis McLouth, Chicago.

LINK BETTER ROADS WITH ARMISTICE DAY

Holiday of Achievement To Be Featured by Patriotic Demonstrations on Highways of Minnesota

Armistice Day Celebrations, Nov. 11. in many parts of Minnesota will feature highway improvements under the new Minnesota good roads program, according to reports of the state highway department. The largest celebration, virtually a 3-day affair, will mark the completion of 175 miles of continuous pavement, extending from Faribault northward through Northfield, Farmington, St. Paul, Minneapolis, Anoka, Elk River, St. Cloud and Little Falls to Belle Prairie. It will begin Nov. 9 at Little Falls and reach a big climax Nov. 11—Armistice Day—at the festival in Faribault under the auspices of the American Legion. City and commercial club officials are co-operating in plans for participation by cities and towns on and adjacent to the long route.

Duluth, Range Towns and Grand Rapids recently celebrated openings on new highway pavements. These improvements were financed with county bond money but state highway officials took part in the dedication ceremonies. Charles M. Babcock, state highway commissioner, at the recent conference on arrangements gave the general plans his hearty endorsement. He remarked, however, that it should not be forgotten that where dimes from the current trunk highway funds have been used for paving, dollars have gone into grading and gravel surfacing and into maintenance of all trunk highways.

Armistice Day called "America's holiday commemorating successful achievement," city officials proposed a general observance of the plan over the state. Newly improved highways make it easier to arrange such celebrations, it was suggested, with parades, dancing and outdoor events in addition to patriotic demonstrations. One official smilingly remarked that automobilists appreciating how better roads are cutting the expense of being pulled out of the mud and of new car springs. more tires and gasoline, would find cause for real hilarity. A map showing nearly 500 separate highway improvements already widely distributed on Minnesota trunk routes under the Babcock program indicated that the great majority of communities can find new roads to celebrate.

Local celebrations are being arranged generally by city and town officials, American Legion men and representatives of commercial organizations.

INDIANA TO OPEN BIDS FOR 1923 PROGRAM

The State Highway Commission of Indiana will open bids on November 15 for the construction of approximately 46 miles of hard surface pavement which is a part of the commission's 1923 building program, John D. Williams, director of the department, announces.

The first construction letting is in four projects, the bulk of which is on the Range Line Road, known as State Road No. 1. Three of the four projects are north of Indianapolis and when pavement is laid it means a continuous pavement from Indianapolis to the Michigan state line excepting about 60 miles between the south line of Miami County and Plymouth. The fourth project to be considered November 15, is on State Road No. 6, between Indianapolis and Lebanon, and consists of about 11 miles on the Indianapolis end of this highway. Last year the commission decided to purchase cement used on state projects and was able to obtain a very low price by buying in large quantities. Contractors bidding on state roads this year will do so with the cement provided by the commission. The storing of cement also has the advantage of assuring a supply at all times and prevent suspension of work because of a lack of this material, a condition very apt to arise in the event of railroad congestion or strikes.

At a recent meeting of the commission with state highway officials from neighboring states, held in the office of J. T. Voshell, District Engineer of the Bureau of Public Roads, at Chicago, Indiana highway officials agreed to meet all neighboring or border states at state lines and connect all federal aid roads. This means that as now planned the Indiana state highway system will have ten connections with Illinois, seven with Kentucky, eight with Ohio and five with Michigan. Two additional connections are planned with the latter state. In other words, the time is not distant when one may take an Indiana state road and continue on it across the border line into any neighboring state.

The Chicago conference met with Capt. P. St. John Wilson, of Washington, D. C., Chief Engineer of the Federal Good Roads Bureau, and succeeded in obtaining concessions that will boost Hoosier highway. The federal bureau recommends not to exceed a 7 per cent grade on all primary roads, and a 10 per cent grade on all secondary roads built in which it participates. Owing to the topography of southern Indiana, the Indiana commission takes the view that to build to these grades is too expensive. A slightly increased grade is cheaper and does not seriously interfere with traffic, it is claimed. Captain Wilson agreed to investigate each project as a special case, and assured Indiana officials that his department will cooperate at all times with the commission to construct better roads as economically as possible.

The federal good roads representatives also consented to a modification of the standard 300-foot radius curve an all new federal aid road construction. A specific case is the Friendship Church on State Road No. 4 near Evansville. Here an approximate 200-foot radius curve was made in order the church property not be damaged. The Federal Roads Bureau further consented to make specific cases of Indiana sand stone for use as base in federal aid projects. This stone does not come up to the French coficient of four in durability, but Indiana highway engineers claim it is cheaper, the State has vast deposits of it and the stone serves our purpose as well.

MEETING OF COMMITTEE ON STRUCTURAL DESIGN OF ROADS

The first meeting of the Committee on the Structural Design of Roads of the National Research Council was held in Washington on October 25. The meeting was devoted to outlining a program for the future activities of the committee, which will be largely along the lines of co-ordination of highway research. Existing research activities will be analyzed and new ones outlined in project statement form. In this way it is hoped to stimulate research along needed lines.

At this meeting suggestions were made regarding the proposed new test sections of the road at Pittsburgh, California. A. T. Goldbeck, Chief of the Division of Tests of the Bureau of Public Roads, is chairman of the commttee. The bureau is also represented by E. W. James, Chief, Division of Design; E. B. Smith, Senior Assistant Testing Engineer, and C. A. Hogentogler, Highway Engineer. Other members of the committee are H. E. Breed, former Deputy Commissioner of New York; H. C. Berry, University of Pennsylvania; Charles Upham, Chief Engineer of the North Carolina State Highway Department; Dr. Strahan, University of Georgia; H. H. Westergaard, University of Illinois; H. G.G. Shirley, Chairman, State Highway Commission of Virginia; Lloyd Aldrich, Engineer in Charge of Tests at Pittsburg, Cal.; F. H. Eno, Ohio State University; Clifford Older, Chief Highway Engineer of the Department of Public Works of Illinois and E. W. Templin, of the Goodyear Tire and Rubber Co.

CALENDAR OF COMING MEETINGS

Federated American Engineering Societies, Washington, D. C.; annual meeting Washington, Jan. 11-22, 1923.

American Roadbuilders Association, New York City; Annual Convention, Chicago, Jan. 15-18, 1923.

American Society of Civil Engineers, New York City; Annual meeting, New York City, Jan. 17 and 18, 1923.

American Concrete Institute, Detroit; annual convention, Cincinnati, Jan. 22-26, 1923.

Associated General Contractors of America, Washington, D. C.; annual meeting, Los Angeles, Jan. 30-Feb. 3, 1923.

NEVADA STATE HIGHWAY DEPARTMENT IS MAKING CHECK ON OVERLOADED TRUCKS USING STATE HIGHWAYS

This week the State Highway Department sent out a state policeman equipped with proper devices and clothed with the necessary authority to make a thorough canvass of overloaded trucks moving over the state highways. This special policeman has a light truck for hauling his testing equipment, consisting of a pair of portable loadometers, and will cover various sections of highway where we feel sure overloaded trucks are making daily use of the roads. Unfortunately, existing laws do not provide any penalty for those found with overloaded vehicles; however, one section of the motor vehicle law provides a means of reaching those offenders who are operating truck lines under a cetificate of public convenience and under the jurisdiction of the Public Service Commission. This section provides:

> For each motor vehicle or trailer operating upon any highway of the first class, the sum of $2 for each 100 pounds of weight of said vehicle and load, based on the vehicle loaded to its capacity; for each motor vehicle or trailer operating upon any highway of the second class, the sum of $1 for each $100 pounds of weight of said vehicle and load, based on the vehicle loaded to its capacity; for each motor vehicle or trailer operating opon any highway of the third class, the sum of twenty-five cents for each 100 pounds of weight of said vehicle and load based on the vehicle loaded to its capacity.

It is very probable that some truck transportation lines are exceeding their licensed capacity, therefore we may be able to compel payment of additional license. The main object of this weight census is to secure data on which to base proposed regulatory laws to be presented to the next session of the Legislature. Such data as is obtained will then be placed before the public in order that all citizens may be fully advised of the folly of allowing a few truck owners to operate over a roadbed paid for by the public, competing with taxpaying rail lines, and destroying a public investment runnng into the millions of dollars. Already serious damage has been done on certain sections and the State Highway Department at least is going to make a determined effort to preserve the public's investment.

IRON RANGE HIGHWAY FORMALLY OPENED

The new Babcock highway that links the towns of the Mesaba range from Hibbing to Grand Rapids by an unbroken concrete highway was formally opened October 18. A caravan of cars from all of the towns on the route journeyed along the highway to Grand Rapids. The business sections in all the towns were gay with bunting and there were band concerts. Speeches of the afternoon were made on the grounds of the Grand Rapids Central High School. H. A. LeSueuer, County Highway Engineer, who had been in charge of the construction, accorded high praise to the Minnesota Highway Department and to the co-operation given by the citizens of Itasca County during the building of the road. C. M. Babcock, State Highway Commissioner, in a short address gave interesting figures concerning the work throughout the state. J. H. Mullen, Chief Engineer of the State Highway Department, declared that the road is as good a one as has been built in the United States. Public officials and business men delivered addresses.

PENNSYLVANIA TO REPLACE ALL NARROW BRIDGES WITH NEW STRUCTURES

It will not be many years before the old narrow stone bridges crossing streams and ravines on state highway routes in Pennsylvania will have passed into oblivion and new structures, or rebuilt old ones widened to meet traffic conditions of today, will grace the highways in their stead.

Motor traffic has increased so amazingly within the past few years that the Pennsylvania State Highway Department has sensed the absolute necessity and importance of wider bridge structures on its road system, which will make it possible for automobiles, trucks and other vehicles to pass each other without danger of collision. A recent survey made by the department shows a total of 1854 bridges less than 16 ft. wide—many of which cannot carry two vehicles at the same time—that are located on roads which have been made a part of the State Highway System. Under the law trucks are permitted a width of 90 in. and, consequently, these old narrow structures constitute an ever present and serious menace to all users of the highways.

Plans now are being prepared to widen the more vitally important ones located on heavily traveled highways, so that when the working season opens up in the spring—and if the present financial resource for repairs is continued—operations may commence immediately. However, some of these structures were built fifty or one hundred years ago and are in such condition that to repair them would not be economical, or advisable, and new construction is therefore necessary, while in some instances the cost of widening is prohibitive at the present time, so that contemplated changes will have to be held in abeyance until further appropriations are available for this purpose.

In the meantime the department is exercising every precaution for the safety of the traveler and warning signs are being erected which read: "Danger: One-way Traffic Bridge."

The policy of the Department is to construct all new bridges with a width of at least 24 ft. and in the improvement of those which are not entirely rebuilt, according to a statement by Assistant State Highway Commissioner George H. Biles, "Every effort will be made by the department to retain the contour and general architectural characteristics of the old structures which are landmarks in the communities where they are located and in many instances replete in memories of per-

BANKING HIGHWAYS AT CURVES

According to a recent announcement from the offices of the Permanent International Association of Road Congresses in Paris the British Minstry of Transport has directed its divisional road engineers to see that local officials in constructing highways in England allow for superelevation of roadways on corner curves wherever desirable. The action was taken following investigation and recommendations by the British Roads Improvement Association, which pointed out the benefits to be gained through banking at sharp curves in the way of safety to traffic. In the event of two vehicles meeting at a curve, it was declared, they could be manoeuvred on a banked curve with more certainty and less risk of skidding. It was also declared that there would be much less wear upon the pavement. French road engineers long ago adopted the banked curve and in some parts of the United States they are now in use.

ILLINOIS SPECIFICATIONS FOR 1923

The following circular has been addressed to all road contractors by the Illinois State Highway Department:

The attention of all contractors who propose to bid on road work advertised for letting October 31, or who propose to bid on work to be advertised at later dates, is called to the new cross-section for concrete pavements.

This cross-section provides for a thickness of 9 in. at the edge of the pavement, tapering to 6 in. at a distance of 2 ft. from the edges. The remainder of the pavement is to have a uniform thickness of 6 in. The amount and arrangement of reinforcement is to be the same as that heretofore used, with the exception of the center joint material, a new design for which has been provided to correspond with the 6-in. center thickness

This new cross-section was adopted as a result of the Bates road tests, which show conclusively that the strength of the edges of any rigid pavement, built in accordance with any design heretofore used, is much less than the strength of the interior portion of the slab.

The Bates tests disclosed the fact that a center thickness of 6 in., or even perhaps 5 in., is ample to support the legal load limit provided by Illinois statutes. The new cross-section takes advantage of this fact. The tests further indicate that even with a 6-in. thickness for the main portion of the slab, a 7-in. edge with the longitudinal bar would still not be as strong as the mid-portion of the slab. The edge thickness has, therefore, been increased.

Particular attention is called to the fact that the new cross-section provides one square foot less of cross-sectional area than a slab having a 7-in. uniform thickness. This means that the new cross-section will require 195½ cu. yd. less of concrete per mile of pavement than the standard 7-in. design heretofore used.

The department believes, therefore, that the new cross-section will provide a pavement which not only is better able to support trucks loaded to the legal limit ,but will also reduce the cost per mile.

ENGINEERS INVESTIGATE "BLACK BASE" PAVEMENTS

The success obtained in the states of California, Oregon, Washington, Arizona and Nevada and the cities of Chicago, Calgary, Washington, Owensboro, Hamilton, Omaha, Pittsburgh, Buffalo, Denver and Saginaw, with asphalt pavements constructed with a "black base" foundation of asphalt sand and stone or gravel is attracting the attention of city officials and paving engineers in the Middle Western states. Washington has some of these pavements which have been in use over forty years. In the past ten years nearly 9,000,000 square yards of the type have been constructed in the United States.

The city of Battle Creek, Mich., has received tenders for this type of construction, and Mayor Chas. C. Green is impressed with the satisfaction that a pavement of this kind near Kalamazoo is giving.

The advantages of the black base type of construction are many, besides a low first cost. Contractors need have but one outfit, as the wearing surface and foundation are laid with the same appliances. The top is laid on the foundation the same day, thus doing away with the time required to harden a hydraulic base. The entire pavement is resilient and, therefore, absorbs impact. Hence it can carry heavier loads . Since asphalt is a water-proofing material, the wearing surface is not affected by water in the subgrade. New York City is using this type of base in repairing asphalt pavements which have been cut in order to rehabilitate underground services.

TREMENDOUS ROAD PROGRAM IN THE SOUTHERN STATES

Southern states have embarked upon a road building program involving the construction of several thousand miles of new hard surfaced roads, most of which will be of asphalt. Florida, Texas, North Carolina, Tennessee and Missouri, especially, are building great stretches of asphalt roads.

The extent to which Southern states are appropriating money for highway construction is reflected in statistics compiled by the Asphalt Association, New York, which show that during the first eight months of the present year 343 bond issues amounting to $86,436,650 have been sold in the 16 Southern states and the funds made available for road construction. Bonds sold in each state were as follows: Alabama, $4,830,000; Arkansas, $2,619,000; Florida, $6,036,000; Georgia, $2,906,000; Kentucky, $1,193,000; Louisiana, $3,786,500; Maryland, $2,319,000; Mississippi, $1,821,000; Missouri, $1,846,000; North Carolina, $25,202,500; Oklahoma, $1,073,000; South Carolina, $3,262,000; Tennessee, $2,034,000; Texas, $25,436,750; Virginia, $1,390,000, and West Virginia, $681,000.

MONTANANS ACT TO SAVE FEDERAL ROAD FUND

A meeting attended by good road boosters from all parts of the state was held recently under the auspices of the Missoula Chamber of Commerce to devise means to save for the state federal appropriations made for good roads. Approximately $1,000,000 of federal money will be lost to the state, it is feared, through the failure of various counties to make the necessary appropriations. If this is not done by July 1, 1923, the federal appropriations will lapse.

PROPOSED BRIDGE OVER MISSISSIPPI TO COST $900,000

Preliminary plans and estimates by N. W. Elsberg, Minneapolis city engineer, on the proposed Nineteenth avenue bridge across the Mississippi River has been submitted to the council road and bridge committee. The plans call for a structure to cost about $900,000 and to be 2,800 feet long. It will be of concrete, 60 feet wide, with two spans of 280 feet each over the river and two shore spans of 250 feet each.

WISCONSIN COUNTIES ASK STATE FOR CONTINUED ROAD AID

Appeal will be made to the Wisconsin Legislature by county boards asking that it continue state aid for highway construction in an amount totaling at least $785,000 annually. The Wisconsin state aid program is completed this year and further provision must be made by the Legislature if it is to be continued. The legislative committee of the County Boards' Association says that certain counties in the state provided for bonds for road building with the expectation that state aid amounting to at least $785,000 annually would be forthcoming for an indefinite period.

FARMERS GET FIRE PROTECTION THROUGH GOOD ROADS

Dallas County, Texas, has made it possible for its rural districts to obtain protection from the fire department in Dallas through the construction of modern hard-surfaced highways. A contract executed recently between the Dallas City Commission and the County Commissioners provides for fire protection to farmers on all paved roads within a radius of 15 miles of Dallas.

Dallas County is one of the first in the country to make such an arrangement. Several fires have already been extinguished with small loss and a general reduction in fire insurance rates in the smaller towns and farming districts has been the result. The service will be made more extensive when the big road building program now under way in Dallas County is finished.

Personal Mention

Ray Z. Meyers, formerly assistant engineer of Licking County, Ohio, has been appointed assistant division engineer of the Ohio Highway Department.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

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TABLE OF CONTENTS

The Construction and Maintenance of Low Cost Road Surfaces 171
By William N. Bosler
Opportunities in the Field of Highway Transport . 173
By C. C. Hanch
A Road Drag Made from War Materials 174

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Election Returns on Bond Issues for Highways Favorable 175
Exhibit Space for Good Roads Show to be Allotted Nov. 17 175
Arizona Highway Department Secures Approval of Interstate Road Program 175
Traffic Tests Begin at Arlington 175
National Highway Traffic Association to Hold Meeting Nov. 21 175
Highway Research Board to Hold Second Annual Meeting Nov. 23 176
Colorado to Survey Holy Cross Trail 176
North Dakotans Urged Good Roads Law . . . 176
University of Michigan Announces 1923 Courses in Highway Engineering 176
Automobile Association Urges Abolishing of Road Bill Boards 177
Calendar of Coming Meetings 177
Personal Mention 177

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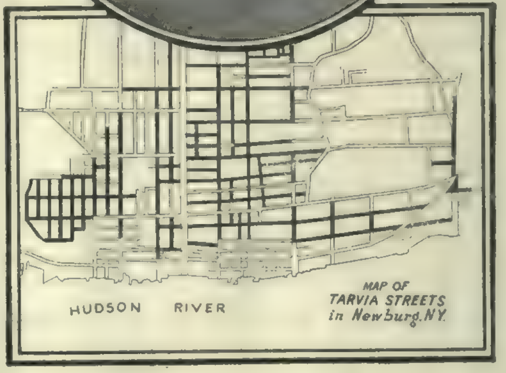
At left: Washington Heights, maintained with "Tarvia-B" since 1916.

Above: Du Bois St., maintained with "Tarvia-B" since 1916.

Below: Benkard Ave., maintained with "Tarvia-B" since 1913.



"Tarvia-B" makes good at Newburgh—

Benkard Avenue, pictured in the circle, was the first Tarvia street in the City of Newburgh, New York. It was treated with "Tarvia-B" in 1913, and again in 1914 and in 1915.

The results were so satisfactory that in 1916 other macadam streets were given their initial Tarvia treatments, and the list has been growing ever since. Not until last year, however, when the 18 miles of roadway shown on the accompanying street map were surfaced-treated with "Tarvia-B", was the use of all other kinds of road-maintenance materials entirely abandoned in favor of Tarvia.

Describing Newburgh's experience with Tarvia, Mr. W. J. McKay, City Manager, wrote under date of March 17, 1922:

> "It is with a great deal of pleasure that I inform you that the results obtained from the use of your 'Tarvia B' on the streets of this city last season were more than satisfactory.
>
> "While we are always in the market for material cheaper than the material we used the preceding season, it would take a considerable difference in price to have us make any change in the product to be used for the season of 1922."

Economy must be the goal of every conscientious public official. And officials of Newburgh, and hundreds of other cities and towns throughout the country, have found from experience that Tarvia is the most economical of all road materials. Some others may be a little cheaper *per gallon* but the small difference in first cost is much more than offset by the big difference in the result obtained.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII., NEW YORK, N. Y., NOVEMBER 15, 1921 No. 20

The Construction and Maintenance of Low Cost Road Surfaces

By WILLIAM N, BOSLER

Asst. Engineer, Kentucky Department of State Highways.

WHEN starting upon a survey, the field engineers should be governed only by two points, the beginning and end of project. Local influences and wishes should not be allowed to dictate the road to pass everybody's front door. As a matter of fact we have today too much evidence of this past interference in the location of our highway systems throughout that country. The engineer on location must be somewhat of a futurist, that is, he must visualize future traffic and urban development of the community due to the new highway. He must study the topography and establish the most direct, practicable, serviceable and economical route within the recognized limits of alignment, curvature and gradient; he must be thoroughly conversant with the geological formations in order to properly lay the grade line and typical cross sections; he must carefully note the watershed areas and subsoil conditions to correctly recommend the proper size drainage structures and foundation sections for the road surface; he must make a complete material survey to determine the quantity and quality of local deposits of road building materials. In a few words the field engineer not only locates but must plan for construction and prepare for future maintenance.

Stabilizing Sub-Grade

It is my personal opinion that the competent locating engineer must necessarily know construction as well as maintenance of highways. In fact location work offers the greatest opportunity to display real engineering ability in highway work, as there is a greater chance to save money by proper location than any other phase of road work. Personally I have never seen a correctly located road that cost too much. It is better business policy to first locate properly and construct as a grade and drain improvement to be followed later by surfacing than to attempt to spread surfacing by sacrificing location because, in the final analysis, the location is one of the few permanent features of the road. In this connection I desire to state that only permanent drainage structures should be constructed regardless of the type of road surface.

Now let us assume that we have built a properly located and drained graded earth road. From a purely construction viewpoint it is far better to allow the road to be seasoned at least one year by traffic and to permit slides to become stable before placing the surfacing. An earth road properly maintained is not a bad riding surface and by this method of procedure you have the additional advantage of time in detecting subgrade failures before placing an expensive surface. An earth road can be kept in good riding condition if the following rules are kept in mind: First, drag after every rain but never when the mud is in such condition as to stick to the drag and spread unevenly; second, drag early and often. If the drag cuts too much shorten the hitch; third, do not increase the crown by throwing too much material to the centre. To prevent this set the drag straight and throw the material to the sides.

Selecting Surface Material

In selecting the surfacing material, the engineer is again governed by finances. The traffic census, future development and local road building materials should be given due consideration in the design and selection of the road surfacing. I am a firm believer in the merits of all road paving materials on the market today when used within the proper limits of traffic and precept of design. However, I do not believe there is any highway authority, regardless of his experience, that can conclusively prove that any known type is permanent and should be universally used on our main trunk highway system. If investigations are carried far enough existing failures will be found in all types of pavement and this is not necessarily due to the material itself but can be caused by faulty design, excessive traffic or poor construction. Again because a certain type of surfacing is successful in Maine or Texas does not warrant that it would prove the same in Kentucky. Difference in topography and climatic conditions also enter into the selection of road surfacing material.

Naturally the taxpayer will demand the best returns in service for money expended by the public official on roads as he does in his private investments. It therefore becomes incumbent upon us to thoroughly investigate and utilize to the utmost local road building materials for our road surfaces. As a matter of fact a road built of native materials, if properly maintained, is a better road for every purpose than one which is constructed of much better material at a greater cost but which is not properly cared for. In the use of local material by increasing the thickness of the surfacing section we can secure a more economical improvement than by importing materials from other states. The first or original cost will be less and during construction additional material can be stored on the site of work at a reasonable charge to care for future maintenance. In certain sections of the state we have an abundance of creek, bank and river gravel, limestone, sandstone and slag of good quality. In Western Kentucky owing to the availability of material we have constructed a large mileage of bank gravel and clay gravel roads and should continue to do so, for although not a permanent type, it proves with proper maintenance, to be very serviceable and a good return for the money invested. The real secret of success with any gravel road is the ability to keep just enough moisture in the road; too much water is no worse than too little. The surface of gravel roads can be kept in first class condition under reasonable traffic by dragging. This is very important and requires excellent judgment. The maintenance man must know from experience when the surface is in the right condition to drag, how much crown is best for the surfacing material and above all must be willing to get results at one operation. Incompetent men on gravel maintenance means wasted money and no results. More depends upon the execution of the work and experience of the man in charge than upon the methods used. A roadway should be kept uniform in cross section from ditch to ditch not only to prevent water damage but also to distribute the travel so as to eliminate ruts. Concentrated travel on one section of surface will soon wear out a gravel road. If experiments now being conducted by this Department, namely surface treating gravel roads, prove successful we are of the opinion that maintenance cost can be reduced and the life and serviceability of this type greatly increased.

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*Abstract of a paper presented before the Highway Convention held at University of Kentucky.

What has been said of gravel construction in western Kentucky is equally true of waterbound, limestone and slag macadam in central and eastern Kentucky. Our local material for limestone macadam is of a varying quality but when properly constructed and surface treated gives excellent satisfaction. It is the policy of this Department to surface treat all limestone macadam with a bituminous carpet treatment one season after original construction, it being our practice to apply carpet treatment in two applications: a prime or light coat followed by a second or medium coat of bituminous material. Frequent applications of light material and small gallonage give better results than heavy material and large gallonage. Too heavy a bituminous carpet is worse than one too light. It is our general practice to construct waterbound slag macadam in detail as a limestone macadam and likewise to surface treat new construction after being thoroughly seasoned by traffic. In some sections of eastern Kentucky we have a local deposit of sandstone which we utilize as a hand-napped base course supplemented with waterbound limestone macadam top or wearing surface. This also has proven economical and a satisfactory road surface when given the customary surface treatment.

Reconstruction

The next subject for consideration is reconstruction. Ordinarily speaking the general alignment of the existing road surface must be followed because of permanent land improvements, however, changes in curvature, gradient and small revisions in alignment, installation of new drainage structures and additional right of way will be found necessary to improve the safety of traffic. As regards design the depth of existing surface material is generally considered as having a value of 50 per cent. Additional new surfacing must be added to bring the compacted thickness to the requirements. Scarification and reshaping are necessary to produce the required cross section, then the usual method of constructing the type in question, all of which is to be followed by a bituminous carpet treatment. A great many miles of waterbound limestone macadam roads in this state that are considered by laymen to be practically worthless could have been saved in the past by the proper maintenance methods, but unfortunately at that time such matters came within the jurisdiction of the county and was neglected to such an extent that what could then have been resurfaced now has to be reconstructed and cost nearly as much as original work.

A few words to the county officials regarding this matter may not be amiss. Consider your highways in the same attitude as a railroad company views its property. As soon as it is constructed, start maintaining and keep maintaining as long as the road is to be used as such. If you would only spend one-half in maintenance of what you will lose by not maintaining, your roads would all be good and at the end of ten years' time you will have something to show for your money besides and experience and depleted highways. Do not discard your present roads because they are badly worn. Salvage and revive them and get useful mileage rather than attempt too much high and costly types of surfacing. Your original investment should by all means be saved whether the road be earth, gravel, slag or limestone. I am afraid we are too prone in this day of fast vehicular travel to demand the costly and easy-riding surface and in many instances discard what would prove useful. We cannot all live in stone or brick mansions and ride in Pierce-Arrow limousines. Consider the money invested in original construction, plus interest on same, plus yearly maintenance necessary to produce a serviceable road for the demands of traffic when comparing types for the purpose of selecting and answer your own local questions.

Economical Methods

In the final summation my personal belief leads me to say that 75 per cent of the traffic in this state can be served satisfactorily for the next ten years by construction using local materials, surface treating and properly maintained. Understand me correctly, I do not wish to discourage construction of high type road surfacing, but I do wish to avoid breaking our financial back for mere appearance's sake. The day has unquestionably come when higher types of road must be built but what Kentucky needs now is a large mileage of surface roads rather than a small mileage of high-priced highways. Unfortunately there is not money available to build all roads at once and we must save our assets as exists in the old pikes until we have the price for new ones. By means of careful patching, constant patrolling and surface treating, it is possible and not to expensive to save money on old roads. As additional money becomes available resurfacing can be carried on and eventually everyone will have a good road.

If we want to spend money properly, invest in the very best location and installation of permanent drainage structures and place thereon a surfacing of local material adequate for traffic which can be maintained as a serviceable road at a minimum. cost. Most any engineer with unlimited funds can locate, design, construct and maintain a costly improvement, but it requires real engineering ability to use native materials, adapt them to local conditions and serve the people economically and satisfactorily.

Improved roads in Wyoming have increased from a total mileage of 1,724 in 1914 to 6,867 in 1921, according to the U. S. Bureau of Public Roads.

When children and workers in our eastern cities are underfed and corn in Iowa, potatoes in Virginia, and fruit in California are allowed to rot, something is wrong with the system of transportation. Highway transport can play an important part in the solution.

Eighteen feet of roadway is the minimum width recommended by the U. S. Bureau of Public Roads for primary roads.

Trunk-line highways mean too much to the commerce of the nation to allow them to be closed by snow. Now is the time to lay plans for snow removal.

Opportunities in the Field of Highway Transportation

By C. C. HANCH

Vice President, National Automobile Chamber of Commerce

THE university which establishes special courses in highway transport quite rightly asks the question "What opportunities are there for our graduates in the long run?"—and more definitely "What jobs are they likely to find in the field of motor transport immediately upon graduation. I shall try to answer both of these questions briefly and directly, but to do this completely, I must first indicate for a moment something of the extent and history of the automobile industry.

It is perhaps relevant to say that the automotive industry within the space of its short manufacturing career has advanced until it is today third among the industries of the United States in value of annual output, affording annual employment to some 2,431,000 employes who earn their wage either in the output of the car itself or in producing the materials which go into the vehicle. Of this number, some 600,000 are in the industry itself.

Today there are some 10,500,000 motor vehicles in the United States, or one to every ten people in the country. The total world registration is but 12,500,000, so that it appears at once that 83 per cent. of the cars in use are in this country. Of this total, some 87 per cent. are manufactured in the United States.

No man here today can forecast fully the directions which the use of the motor vehicle will take. Each day finds some new place for it. Each day the social and economic influence of the car extends into some new field and throughout the world the instinctive human desire for individual transportation asserts itself in the demand which we see reflected in a constantly growing use.

The Development of a Decade

This development has taken place within a decade and, like every new development in our civilization, it has brought in its wake new questions, or rather old questions demanding new answers. The swaddling clothes of the infant will not fit the growing boy. The advance in ten years from 600,000 to 10,500,000 cars brings with it new requirements in methods, whether they be legislative, industrial or financial in nature. New practices, new customs are before us and only trained men can give us the key to their solution.

Before we can give a categorical answer to the question of what the field of opportunity is in this industry, however, certain conditions must be laid down which will be recognized by every educator as limitations older than education itself, as old as human nature.

College education in itself is not the be-all and end-all. Behind college education there must be those enduring traits of human character which are always essential to success. Perseverancee, intelligence, honesty, willingness to learn and to work are fundamental. The textbook must be supplemented by the overalls. University training supplies the spiked shoes but every man must start at scratch and in the long run, the best will win.

Further it must be recognized that the industry is but now entering upon a new phase in its development. Initially, the manufacturer was concerned with evolving a practical motor vehicle. Next, he found it necessary to develop manufacturing facilities adequate to meet the enormous immediate public demand. This accomplished, he has arrived today at the point where the motor vehicle has become a major unit in transportation, requiring minds of varied training in such fields as civil, chemical, metalurgical and electrical engineering, economics, business administration and finance, research in physical and commercial lines and many other branches, including public service.

The industry is in the pioneer stage of this step in its progress. It will proceed rapidly or slowly according to the recognition which educators give to the magnitude of the educational need involved and according to the facility with which university and industry learn to work together in this common cause. The question again becomes one of personality. The university man must be willing to begin at the bottom and must display the ability to grasp the opportunity afforded. The matter of securing employment is an operating detail which will be worked out as the quality of the college graduate demonstrates his fitness for the job.

The Need of Trained Men

If the man's training has been in the field of highway construction, the question of where such jobs are to be found is a matter not directly related to the automobile industry. On the other hand, if a man has taken courses preparing him either for work within the factory or in the uses of motor transport, he should be able to find his place somewhere in the automobile industry.

When he first comes out of college he may get a job with is altogether probable that he will not be put on the exact a research department and find that he is a salesman. It type of work that he ultimately wishes to perform when he first goes into the factory. He maybe taught something about the field and then sent out on the road for a month or two. No matter what section of the work particularly appeals to him, he is always sure to benefit from some sales experience. He must learn to bear in mind that motor transport is a means not an end. The answer to the value of every type of design is "Does it please the user?" "Is it of greater value to the man who is operating a car or truck?" Actual experience in selling is one of the greatest possible schools teaching practical conditions which the designer must face. Many a beautiful design has been worked out in a laboratory which would not stand the test of the open road.

The field of opportunity, broadly speaking, can be divided into two classes, those within the manufacturing plants themselves and those in the extension of motor transport. The first class offers a field of opportunity in five distinct divisions. Research and design is the first of these. It affords a limited field in every factory where the services of a chief engineer and assistants will be required at salaries on a parity or higher than those of similar employment in other large manufacturing industries. Among the problems with which men of this type will have to deal may be enumerated the following:

1. Development of light metals with high tensile strength.
2. Designing of carburetors which will reduce fuel consumption.
3. Improvement of braking and spring facilities.
4. Building of a simpler transmission.

Abstract of an address presented before the Conference on Education for Highway Engineering and Highway Transport held at Washington, D. C., October 26-28, 1922.

5. Advance in headlighting system which will obviate glare.

6. Simplification of construction.

7. Development of equivalents for existing materials.

Fabricated production is the second phase. Here again, the field is limited but obtains in every factory. The chief problems involve questions of serial and mass production. The men in charge must be equipped to bring about modifications in factory practice to meet with changing requirements of design and to effect economics in production. The educational requirement is a study in engineering.

Purchasing is another field which is common to all factories and requires the services of at least one highly paid man and assistants whose salaries will depend upon the size of the factory. These men should be thoroughly grounded in business practice, and preferably, should have an engineering knowledge of the materials they buy.

Sales and extension work is one of the largest fields of employment in the salaried field in the industry. Compensation there, as in all sales fields, depends directly upon the ability of the man. In general, the applicant should know the principles of pyschology, business practice and economics. If he is in the motor truck field, especially, he will have to have a thorough knowledge of economics.

The fifth and last field is a specialized one—the highway transport engineer. This man should be both an engineer and an economist. He is in fact a glorified salesman, who must be able to map out selling campaigns on a mass scale dependent upon the growing field of highway transport, as for example, in the use of the motor bus in connection with consolidated schools, the use of passenger fleets for traveling salesmen, etc. This field is limited but again the compensation is in proportion.

The second large class of employment has to do with the operation of the vehicle in the field as a phase of highway transport and with the extension of sales promotional effort by the dealer.

Highway transport, as such, offers employment for a large and growing group of fleet owners, superintendents, dispatchers and operators. The colleges are generally concerned only with the first two classes. Education for these fields should include a general knowledge of economics, business practice and sufficient engineering to enable the man to build and conduct service stations, etc. This field offers attractive remuneration for the owner and a few very high salaries for the superintendents.

The dealer is the pivotal point in the future of the industry. His is the immediate contact with the public. He should have a general training in business practice, economics and pyschology. He must be a leader. The field is very large and the reward in proportion.

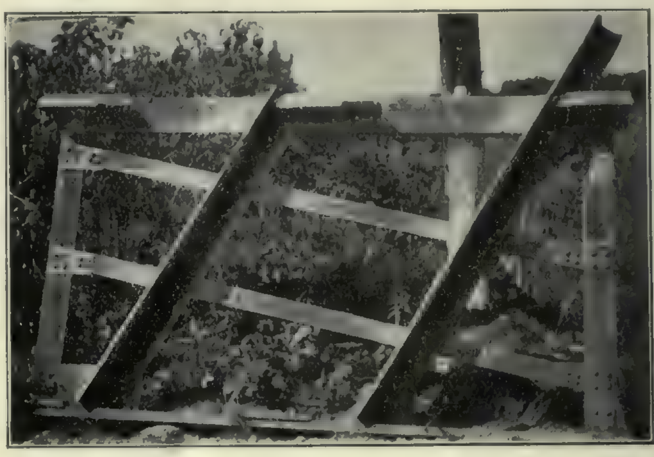
Beyond these fields and as a direct offspring of the motor industry there are the allied fields of the city planning commission, the traffic engineer and the transportation expert of the state highway department. These fields come under the head largely of public service. They will require many men of vision, with a thorough grounding in economics, sociology and engineering. Finally, it may be said that the field in prospect is not limited to the confines of the United States. While the position in manufacturing will continue to rest largely with those employed in this country for many years to come, and perhaps as long as there is a motor industry, foreign countries will turn more and more to us for leaders to carry on the work of extending motor transport throughout the world. As world conditions become more settled, countries now practically barren of modern highway transport facilities will need men trained to these tasks.

How shall one of these university graduates set about to get a job in the automobile industry? There is no sure road any more than in other business, but by the time next June's graduates are ready, the industry expects to have worked out a plan which will keep it in touch with the available men. Whether this will take the form of a University Contact Bureau in the National Automobile Chamber of Commerce or whether some other method will be adopted has not been finally determined, but a definite effort is being made to outline a program which will keep the factories in touch with the more promising men who are being graduated. In conclusion let it again be said that the opportunity necessarily depends upon the man's ability and enterprise. All we can do is to give him an entry in the race.

A Road Drag Made from War Material

THOUSANDS of pounds of steel eye-beams designed and sold to the Federal government when this nation was at war, are now doing peace time duty on Indiana state roads, having been fashioned into admirable drags for levelling and scraping gravel and stone highways.

In the Indiana state roads system, comprised of approximately 4000 miles, there are 2800 miles of stone and gravel roads. The latter are known as secondary roads, and are being extended from time to time, following the policy of Governor Warren T. McCray, who favors a secondary system of native materials in places where traffic is not so augmented and where the more costly rigid types of concrete, brick and bituminous concrete are unnecessary. According to highway commission members the major portion of structural eye-beam steel consigned to Indiana by the U. S. Bureau of Good Roads has been converted into drags and serves well this purpose, especially if the roads are dragged three and four times each week which is the custom on Hoosier state highways.



While structural steel drags made ideal implements for road work, no claim is made for their superiority over commercial drags composed of a harder tempered steel. Neither is the structural steel drag intended as the most economical design if one was purchasing new material. It is merely a means of utilizing to good advantage old steel given the state by making a type of drag satisfactory under several conditions on certain types of roads.

When the flanges of the improvised drags wear on one side, the "I" beams are unbolted and turned, and the other flanges utilized as a wearing surface. Finally when the flanges are worn to the degree they no longer are servicable for dragging roads, they are sent to the state garage and manufactured into bumpers for approximately 1,000 motor trucks used in the maintenance of Indiana state roads.

Current Events in the Field of Highway Engineering and Transport

Election Returns on Bond Issues for Highways Generally Favorable

New Jersey $40,000,000 Road and Bridge Issue Wins — Colorado Votes $6,000,000

A general favorable vote was cast on Nov. 7 for bond issues for road construction and bridges. The largest bond issue voted upon and carried was a $40,000,000 issue in the State of New Jersey for roads and bridges.

The New Jersey bond issues makes available $5,000,000 per year for the completion of the state highway system as laid out, and $3,000,000 per year for necessary bridges. Thus a five-year construction program is provided. Approximately 375 miles of the state highway system as laid out previous to the last session of the New Jersey Legislature are to be completed. A permanent type of surfacing will be laid. A sinking fund secured from a general levy of one mill will provide money with which to pay the interest on the bonds and finally retire them.

Colorado also voted favorably for bonding itself for the construction of highways, a $6,000,000 issue having been authorized. These bonds are to run for nineteen years and funds for interest and principal will come from motor vehicle license fees. Yearly appropriations of $1,500,000 will be made from this issue, providing a four-year construction program. As provisions have been made for road work in the 1923 budget, the $6,000,000 will not become available until the succeeding year.

EXHIBIT SPACE FOR CHICAGO GOOD ROADS SHOW WILL BE ALLOTED NOVEMBER 17

Allotment of space for the Good Roads Show, to be held in Chicago, Jan. 15-19, 1923, will take place Nov. 17. Several plans of conducting the drawing and assigning space to exhibitors were discussed by the directors of the Highway Industries Exhibitors Association under whose auspices the show will be conducted and by resolution the Exhibitors Committee was empowered to decide upon the procedure which, in its opinion, would best serve the interest of the exhibition and the manufacturers.

At the meeting of directors organization and constitutional details were approved and all of the old officers were reelected to serve until March 1, 1923, when a new fiscal year will begin.

ARIZONA HIGHWAY DEPARTMENT SECURES APPROVAL OF INTERSTATE ROAD PROGRAM

Arizona has secured approval from the U. S. Bureau of Public Roads of its Seven Per Cent. highway system, this being one of the earliest approvals of such systems in the United States.

The Arizona Seven Per Cent system embraces approximately 1460 mi. of Federal-aid road, 900 of which are already improved or under construction. Ninety per cent. of the roads previously constructed by the state and territory are included in the system, the 10 per cent. exception being the road between Parker and Bouse, 26 miles of the Prescott-Jerome highway, the Apache Trail, the Clifton-Solomonville and Clifton-Duncan roads, the Mule Creek connection with Silver City, New Mexico, and the Tombstone-Patagonia road.

The National Seven Per Cent system of highways constitutes approximately 180,000 miles of roads which the federal and state highway authorities consider of greatest value. The Seven Per Cent. legislation was passed by Congress in a desire to concentrate federal road expenditures on the main arteries of transportation. The highway act provides for cooperation by the federal government with the states in the improvement o fbut seven per cent. of the total road mileage in each state, hence the name "Seven Per Cent system."

In length Arizona's portion of the Seven Per Cent System is less than one per cent of the total mileage in the United States. Nearly two-thirds of Arizona's Seven Per Cent system is already improved. The Federal Government has authorized the expenditure of $50,000,000 on the national system for the fiscal year, $65,000,000 for the next year and $75,000,000 for the year following. Arizona's proportion is approximately 1.4 per cent of the total.

At the present rate of progress, it is conservatively estimated by the Arizona Highway department that Arizona's Seven Per Cent system will be so improved within the next 15 months that it will be possible to average 30 miles per hour in traversing any road across the state. In addition several important state road connections with the system will be made during this period.

TRAFFIC TESTS BEGIN AT ARLINGTON

Traffic has been started on the circular track of the Bureau of Public Roads of the United States Department of Agriculture, at the Arlington Experiment Station, in the experiment to determine the cause of waving in bituminous surfaces. The track is composed of 27 sections of asphaltic concrete of different mixtures.

Before starting the traffic, profile measurements of the surface were taken with the autographic profile device especially devised for the purpose. Measurements were taken at frequent intervals and will be repeated from time to time as the tests progress in order to determine the rate of formation of inequalities in the surface.

It is also planned to study the flow of the bituminous concrete under traffic. This will be done by noting the movement of brass plugs placed in the surface both in the upper and lower portions.

At present traffic is being confined to a path 2½ feet wider than the distance between outside edge of tires in order to obtain an accelerated test. This will also leave a space on the track for investigation under summer temperatures.

The wear test on the circular track consisting of 61 sections of concrete and located at the outside edge of the bituminous track has also been commenced. In this test concrete made of a great many different materials and mixes is being subjected to a traffic of two solid rubber-tired wheels loaded with 600 pounds per inch of width of tire or approximately that of a 5-ton truck and traveling at a speed of 20 miles per hour. The device used will be guided by wheels traveling on rails and is electrically driven, the power being transmitted to one of the wheels used to represent the traffic which will make this wheel act as the drive wheel of a truck.

On both the bituminous and the concrete wear test, traffic will run continually during working hours, but from the nature of the tests thousands of trips and a considerable period of time will be necessary before much data is secured.

NATIONAL HIGHWAY TRAFFIC ASSOCIATION TO HOLD MEETING ON NOVEMBER 21

The North Central Division of the National Highway Traffic Association and the Michigan State Good Roads Association, will hold a joint meeting at Grand Rapids, Michigan, on November 21st. Both afternoon and evening sessions are being planned. Roy D. Chapin, Director of the National Highway Traffic Association, will preside at the afternoon sessions, and H. R. Hargreaves, Vice-president of the North Central Division of the National Highway Traffic Association, will preside in the evenings. The following papers will be presented:

"Regulations Covering Speeds, Weights and Dimensions of Motor Trucks, Tractors and Trailers", George H. Pride, Treasurer, National Highway Traffic Association, and President, Heavy Haulage Company, New York City.

"Regulation of Overloading of Motor Trucks", David C. Fenner, Manager, Public Works Department, International Motor Company, New York City.

"Lights for Highway Vehicles: Motor Driven and Horse-Drawn", David C. Beecroft, Vice-president, North Atlantic Division, National Highway Traffic Association, and Directing Editor, The Class Journal Company, New York City.

"Equitable Distribution of Cost of Construction, Interest on Bonds, Replacements and Maintenance of State Highways", Roy D. Chapin, Vice-president, National Automobile Chamber of Commerce, Inc., and President, Hudson Motor Car Company, Detroit.

"The Economic Value of Highway Transport Franchises", Arthur H. Blanchard, President, National Traffic Association, and Professor of Highway Engineering and Highway Transport, University of Michigan.

The first printed issue of the "Montana Highway News," the official news publication of the Montana Highway Department, has just been published. It is devoted to the dissemination of knowledge of the work and problems of the Montana Highway Department and is being mailed free of charge to newspapers, county and city officials, contractors, interested citizens and others.

HIGHWAY RESEARCH BOARD TO HOLD SECOND ANNUAL MEETING NOVEMBER 23 AND 24

The Advisory Board on Highway Research of the National Research Council, will hold its second annual meeting at the headquarters of the National Research Council, Washington, D. C., on Nov. 23 and 24.

According to the program the first session will be devoted to committee reports as follows:

On economic theory of highway improvement, T. R. Agg; structural design of roads, A. T. Goldbeck; road materials, H. S. Mattimore; traffic analysis, G. E. Hamlin; highway finance, J. G. McKay; maintenance, W. H. Root; ways and means, C. J. Bennett. The evening session will be devoted to technical papers and discussions.

On Nov. 24 research work in progress by the U. S. Bureau of Public Roads and the Bureau of Standards will be inspected.

TENNESSEE'S LONGEST HIGHWAY CONTRACT

Federal Aid Project No. 14 is the longest highway contract ever let in Tennessee. It consists of five miles of new road in Grainger County, beginning at Fate Springs, forty-three miles across Hawkins County and two miles in Sullivan County, extending to Kingsport—a total length of 50.2 miles. The new highway passes through the Holston River valley for about forty miles and lays between Bay Mountain and Clinch Mountain. The grading on this contract was begun in 1920 and the construction of the macadam base in 1921. The road will be surfaced with asphalt throughout and will cost $1,387,000, or $27,700 a mile.

COLORADO TO SURVEY HOLY CROSS TRAIL

Survey of the Holy Cross Trail has been started by the Colorado State Highway Department under the direction of John P. Donovan, division engineer. The start of the survey was made on top of Loveland Pass and the party is now working toward Dillon. It is expected the survey will be completed this fall. None of the grades will exceed 6 per cent.

It is proposed to build two stretches of road between Silver Plume and Redcliff. The Trail will cross two 11,000 foot passes—Loveland and Shrine. The distance between Denver and Redcliff will be reduced by approximately 100 miles. The present route by way of Buena Vista and Leadville is about 200 miles. Likewise the proposed road will bring Denver within 150 miles of Glenwood Springs. It passes through one of the most romantic mining sections in the west.

About sixteen miles of the Loveland Pass road will be located on a new survey; the balance of the distance between Graymont and Dillon will follow the old stage route.

The cost of the two stretches of road will be aproximately $300,000, and will provide one of the finest scenic and commercial roads in Colorado. Officials of the State Highway Department say the amount of money to be apportioned to the Holy Cross Trail the next two years will depend upon the action of the voters on the proposed highway bond amendment at the coming November election.

NORTH DAKOTANS URGE GOOD ROADS LAW

The executive committee of the North Dakota Good Roads Association has decided to go before the next North Dakota Legislaturt with two bills, on creating a highway commission on a new plan and the other providing for a state highway fund and a constitutional amendment which the Legislature will be asked to refer to the people for a vote, creating a State Highway Sysem. I. J. Moe, Valley City, is president of the association.

SEPTEMBER MOTOR TRUCK OUTPUT 27 PER CENT ABOVE LAST YEAR

Reports of the U. S. Department of Commerce record that motor-truck production in September, 1922, was 27 per cent above September, 1921, though showing an expected decline from summer business. The output for September this year was 18,843, for August this year 24,200 and for September, 1921, 13,646.

MONTANA'S HIGHWAY NEEDS

The Montana State Highway department says that well graded and drained surface highways represent the type of road improvement that seems to meet adequately Montana's traffic requirements. Of all the 67,000 miles of public highway in the state probably not more than 100 miles carry a traffic which justifies improvement with a so-called paved road surface. The advantage of a gravel surface in addition to its economy is this: Traffic is offered immediately a substantial road surface which regardless of weather conditions will render satisfactory service the year round; and when the traffic justifies a higher standard or more expensive type of road surface, the best foundation that can be made use of is already in place.

Montana needs but a relatively few miles of high class and expensive pavements. Montana needs not less than 5,000 and probably 10,000 miles of good substantial gravel roads just as speedily as they can be obtained.

University of Michigan Announce 1923 Courses in Highway Enginering

The University of Michigan has just announced its schedule for the 1922-1923 graduate short period courses in highway engineering and highway transport which will be offered by the university during the winter period, December, 1922, to March, 1923. The University of Michigan is the only institution offering such courses for credit towards advanced degrees.

The attendance on these courses has steadily increased during the past three years as indicated by the following data: 1919-1920, 29 men; 1920-1921, 45 men, and 1921-1922, 94 men. The average age of the men in attendance last winter was 27 years varying from 22 to 54 years. They came from national, State, county and municipal highway departments; consulting engineers' offices, contractors' organizations, university faculties, companies manufacturing highway materials and machinery and the field of highway transport. Last June the University conferred sixteen master's degrees on graduate students specializing in highway engineering or highway transport, and the Board of Regents, in recognition of this rapid development, has assigned to the Division of Highway Engineering and Highway Transport 26,000 square ft. of working space for the Davis Library of Highway Engineering and Highway Transport, offices, graduate lecture rooms, drafting rooms and laboratories in the new $750,000 Engineering Building.

HIGHWAY ENGINEERING AND HIGHWAY TRANSPORT 1922-1923
GRADUATE SHORT PERIOD
COURSES, UNIVERSITY OF
MICHIGAN, ANN ARBOR,
MICHIGAN

December 4 to 15, 1922

C. E. 77. Highway Engineering Financing, Management and Organization. Professor Smith.

C. E. 81. American and English Highway Transport Methods. Professor Blanchard.

December 18 to 30, 1922

C. E. 67. Highway Transport Economics and Surveys. Professors Blanchard and Smith.

C. E. 72. Gravel and Groken Stone Roads, Dust Prevention and Bituminous Surfaces. Professors Blanchard and Smith.

January 1 to 12, 1923

C. E. 73. Brick, Cement-Concrete, Stone Block and Wood Block Pavements. Professor Bateman.

C. E. 80. Interrelationship of Highway, Railway and Waterway Transport. Professor Riggs.

January 15 to 26, 1923

C. E. 69. Highway Laboratory Research. Professor Bateman.

C. E. 70. Highway Structures. Professor Gram.

C. E. 82. Highway Transport Costs and Record Systems. Professor Smith.

January 29 to February 9, 1923

C. E. 68. Bituminous Macadam, Bituminous Concrete and Sheet Asphalt Pavements. Professor Blanchard.

C. E. 84. Highway Transport Management. Professor Smith.

M. E. 40. Mechanism, Operation and Maintenance of Motor Trucks, Tractors and Trailers. Professor Lay.

February 12 to 16, 1923

Ninth Annual Michigan Conference on Highway Engineering.

February 19 to March 2, 1923

C. E. 71. Highway Specifications, Contracts and Jurisprudence. Professor Riggs.

C. E. 79. Highway Transport Legislation and Traffic Regulations. Professor Blanchard.

March 5 to 16, 1923

C. E. 75. Highway Engineering Seminar. Professors Blanchard and Bateman.

C. E. 76. Highway Engineering Theory and Design. Professor Smith.

C. E. 78. Earth and Sand-Clay Roads and Grading Machinery and Operations. Professor Bateman.

C. E. 83. Highway Transport Seminar. Professors Blanchard and Smith.

CALENDAR OF COMING MEETINGS

Federated American Engineering Societies, Washington, D. C.; annual meeting Washington, Jan. 11-22, 1923.

American Roadbuilders Association, New York City; Annual Convention, Chicago, Jan. 15-18, 1923.

American Society of Civil Engineers, New York City; Annual meeting, New York City, Jan. 17 and 18, 1923.

American Concrete Institute, Detroit; annual convention, Cincinnati, Jan. 22-26, 1923.

Associated General Contractors of America, Washington, D. C.; annual meeting, Los Angeles, Jan. 30-Feb. 3, 1923.

PORTLAND CEMENT OUTPUT IN SEPTEMBER, 1922

September was the fifth consecutive record-production month in the portland cement industry according to figures of the United States Geological Survey just released. Daily production was at the rate of 381,000 barrels, as compared with 376,000 in August, the best full month on record. Since April production has been at a monthly rate well over 1,000,000 barrels in excess of the best previous months on record. Shipments during September, although totaling less than August, because of transportation difficulties and car shortage, were at the rate of over 1,600,000 bags per day.

Shipments of portland cement this year will probably total close to 110,000,000 barrels, as compared with 98,000,000 during 1920, the best previous year. For the past five months portland cement plants of the country have been producing at the rate of 137,000,000 barrels per year, which means that when the farmers and the railroads again enter the construction market, there will be plenty of this useful material to meet their needs.

Personal Mention

G. C. Brown, of Lufkin, Texas, has been appointed county engineer of Hardin County, Texas.

Guy R. Johnston, until recently principal assistant engineer for the Tarrant County Highway Department, Ft. Worth, Texas, has resigned to become engineer for the Hamer Contracting Co. of Ft. Worth.

P. H. Devine of Hidalgo County, Texas, has been appiinted highway engineer for Starr County. He is stationed at Rio Grande City.

F. D. King, attached to the engineer's office of the city of New Orleans, has resigned to accept a position with the Louisiana State Highway Department. Mr King will be connected with the maintenance department, with headquarters at Monroe, La.

R. J. Windrow, former chief engineer of the Texas Highway Department and at present consulting engineer with the Missouri State Highway Commission/has acquired an interest in the contracting business of Smith Bros., general contractors, Dallas, Tex. Mr. Windrow is actively connected with the business as chief engineer. He still maintains his connection with the Missouri State Highway Commission retaining an office in Kansas City, and dividing his time between that work and private business in Texas.

A. A. A. URGES ABOLISHING ROAD BILLBOARDS

Protest against the defacement of highways by unslightly road sign billboards are being received at National Headquarters of the American Automobile Association almost daily. According to A.A.A. officials there seems to be a great and crying movement against the use of these billboards among the membership of the A.A.A. in every part of the country. All sorts of remedies for the abatement of this nuisance are suggested in these letters, from the enactment of suitable legislation to a refusal on the part of motorists to purchase any articles so advertised. In addition to the marring of highways, it is pointed out, the billboard constitutes an absolute menace to the motorist by attracting his attention from the road ahead and often causes a more or less serious accident.

"I believe that the road sign billboard should be abolished", said President George C. Diehl of the A.A.A. "These signs serve as a distinct menace to motorists, especially when they are placed, as many of them are, at a sharp curve or a road intersection. A motorist driving along the righway and approaching such sharp curve or road intersection wants to see what is around that curve or down the intersecting road much more than he wants to see a huge sign advertising "Whoziz" Tires or somebody's patent medicine or chewing gum.

"The day of the billboard and the need of such methods of advertising is past. The class of people who use the highways and to whom such signs presumably appeal are a class that read the newspapers and magazines, and who are governed largely in their purchases by the advertisements of reliable products advertised in a reliable newspaper or magazine. It would appear to me that the intelligent advertiser would soon become aware of this fact and would transfer the money spent on billboards which constitute an affront in the eyes of most intelligent citizens, to legitimate newspapers and magazines, where such advertising would have weight.

"With the general trend of opposition to billboard advertising developing over the country, as is indicated by letters received at the A.A.A. Headquarters, it can be but a question of time until the American public will take things into its own hands and find some means for the abatement of this nuisance."

OREGON'S WELL-PLANNED HIGHWAY SYSTEM

The tentative state highway system for Oregon as outlined in the Fourth Biennial Report of the State Highway Commission embraces 4,458 miles of improved roads. The system includes three east-and-west and three north-and-south trunk lines across the state with many connecting and tributary highways. Forty roads, in all, comprise the system. The most important trunk line is the Pacific Highway running from Portland south to the California state line beyond Ashland. The second north-and-south route is The Dalles-California Highway extending south from The Dalles through Klamath Falls into California. The third route follows the coast line and will be known as the Roosevelt or Coast Highway.

The famous Columbia River Highway, one of the finest asphaltic concrete roads in the world, forms the primary east-and-west route, running from Astoria to Pendleton with a southeastern extension known as the Old Oregon Trail. A second route runs eastward across the center of the state from Newport on the coast to the Idaho state line. A third road composed of several highways crosses the southern part of the state. Once on any one of these roads the motorist can easily reach any section of the state.

The Columbia River Highway is 340 miles long, while the Pacific Highway is 45 miles. Joined to the latter at Portland and Junction City is the West Side Highway, 115 miles in length. Both of the last named roads are paved with asphaltic concrete and are now ready for service.

On December 6, 1920, the State Highway Commission had expended $21,000,000 on the new system. Amounts since made available have raised this total to close to the $50,000,000 mark, including county and government funds spent by the state.

Of the 4,458 miles in the Oregon Highway System 761 miles have been paved—600 miles with asphaltic concrete and 161 miles with hydraulic concrete. Much of the asphaltic concrete has been down for eight years with exellent service and little or no maintenance cost, despite the heavy rainfall which in Oregon usually exceeds forty inches a year.

The Osgood Company, of Marion Ohio, manufacturers of steam shovels, have established a district sales office in New York City, located at 50 Church street, with Mr. M. E. Pullen in charge. All business of the Osgood Company which was formerly handled by Mr. M. E. Davis, the former New York representative, will now be handled through the district office.

OFFICIAL PROPOSALS

HIGHWAY WORK

Notice to Contractors

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M., on Tuesday, December 19, 1922, for the improvement of highways in the following counties:

ALBANY ....(one highway: 0.23)
CATTARAUGUS........(one highway: 0.15)
MONROE ....(one highway: 0.12)
ONTARIO ....(one highway: 0.41)
OTESEGO ....(one highway: 0.48)
STEUBEN ....(one highway: 4.24)
SUFFOLK ....(two highways: Gravity Concrete Retaining wall)

Also for the reconstruction of the following:

MONTGOMERY (two contracts: 1.50 & 2.50)
NIAGARA ....(one contract: 5.13)
STEUBEN ....(one contract: 3.00)
SUFFOLK ....(one contract: 4.50)
TIOGA ....(one contract: 3.18)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose divison the roads are to be mproved or reconstructed. The addresses of the Division Engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
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1 100 H. P. locomotive type boilers on skids.

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1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.

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4 6 ton, 24 in. ga Cummings locomotives.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

Vol. LXIII November 22, 1922 No. 21

TABLE OF CONTENTS

Research in Highway Education 178
By W. K. Hatt

Cooperation vs. Competition Between Motor Truck and Railroad Transportation 180
By W. H. Lyford

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

American Road Builders Completing Plans for 1923 Show and Convention 182

Iowa Pushes Lincoln Highway Improvement . . 182

Indiana to Pave Long Stretch of Lincoln Highway in 1923 182

Forests Service Builds and Maintains 10,984 Miles of Roads 182

Sectional Committee on Colors for Traffic Signals Organized Under American Engineering Standard Committee 183

Winter Work Will Speed Good Roads in Minnesota 183

Missouri Plans for Ambitious Program of Road Building 183

Kentucky Highway Department Shows Rapid Growth 184

Simplified Paving Brick Practice Recommended by U. S. Bureau of Standards 184

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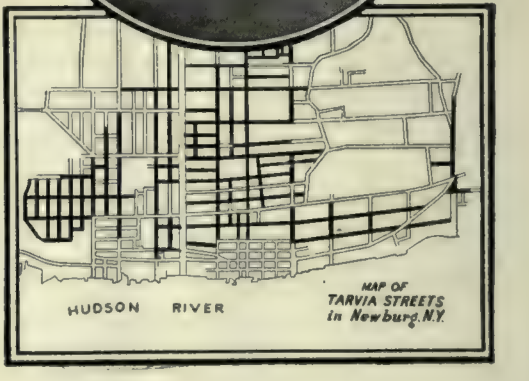
At left: Washington Heights, maintained with "Tarvia-B" since 1916.

Above: Du Bois St., maintained with "Tarvia-B" since 1916.

Below: Benkard Ave., maintained with "Tarvia-B" since 1913.



"Tarvia-B" makes good at Newburgh—

Benkard Avenue, pictured in the circle, was the first Tarvia street in the City of Newburgh, New York. It was treated with "Tarvia-B" in 1913, and again in 1914 and in 1915.

The results were so satisfactory that in 1916 other macadam streets were given their initial Tarvia treatments, and the list has been growing ever since. Not until last year, however, when the 18 miles of roadway shown on the accompanying street map were surfaced-treated with "Tarvia-B", was the use of all other kinds of road-maintenance materials entirely abandoned in favor of Tarvia.

Describing Newburgh's experience with Tarvia, Mr. W. J. McKay, City Manager, wrote under date of March 17, 1922:

> "It is with a great deal of pleasure that I inform you that the results obtained from the use of your 'Tarvia B' on the streets of this city last season were more than satisfactory.
>
> "While we are always in the market for material cheaper than the material we used the preceding season, it would take a considerable difference in price to have us make any change in the product to be used for the season of 1922."

Economy must be the goal of every conscientious public official. And officials of Newburgh, and hundreds of other cities and towns throughout the country, have found from experience that Tarvia is the most economical of all road materials. Some others may be a little cheaper *per gallon* but the small difference in first cost is much more than offset by the big difference in the result obtained.

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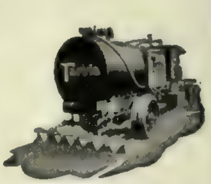

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GOOD ROADS

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WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII., NOVEMBER 22, 1922 No. 21

Research in Highway Education

Its Importance to the Development of Our Future Highway System

By W. K. HATT

Director Advisory Board on Highway Research, National Research Council

SPEAKERS with some message about which they are in earnest, often prefer an audience of young men in college where are formed those persistent habits of thought that to a large extent will guide judgment in the conflict of ideas and of interests in later professional life. The impulse for research and study which many men possess, is less likely to be thwarted by the commitments and urgencies of construction when this research quality of min is developed in college. And this research spirit is important, because not only have the students who are now in college to accomplish the 15 or 20 years of construction ahead of us in creating the main arteries of transportation, —arteries which must be wisely selected to satisfy the economic need of the region, and properly built to conform to the mechanics of the situation,—but these students must also prepare themselves to maintain these highways and operate them in the interests of the public. Routine thinking will not serve the needs of the future.

Highway Engineering a Distinct Branch

This is a branch of engineering as distinct as that of railway engineering, and in many respects demanding wider powers from the engineer. Indeed, highway engineering brings about many new practices to meet the difference in the services rendered by the highways and by the railways. The practice of research is necessary for the advance of the art of the highway engineer to overtake the demands of highway transport that has arisen so quickly and increase so rapidly.

It is not at all remarkable that in those states which are most progressive in highway development, and officered by leaders of thought in highway engineering and highway transport, research activities are most alive, and that, on the contrary, where politicians and promotors of the use of special industrial products find their way into counsel, research is largely disregarded. Solutions of problems of location and construction will be for the common interest, and not conditioned by special pleadings in so far as the discussion is in the light of information determined by scientific research. Our states have many common problems, and the study in Connecticut and Massachusetts should be made available to Illinois and Wisconsin.

A thirty years' stay in academic halls leads me to believe that efforts to stimulate highway instruction and modify college curricula on the part of any external agency must be clearly defined and separated from "Good Roads Movements" in general; that is to say, the activities of those organizations, useful and proper as they may be that are designed to accelerate road construction. This suggestion is based upon the fundamental and necessary quality of educational institutions.

Furthermore, an educational movement of this character must not be narrowed to apply alone to training of civil engineers for building roads. These civil engineers now in practice are well upon their way to the accomplishment of their special duties. A need for instruction is the economics of highway transportation. The part of the national income now spent in highway transportation is disproportionately applied to the vehicle and to the road. College students should be prepared by a scientific training and consideration for the economics of transport to adjust these items of expense arising from the vehicle and from the road. A discussion of the earning power of capital expenditures in road construction in terms of reduction of transportation costs must enter into highway transportation courses, and a body of sound doctrines promulgated through the colleges.

Research Data a Foundation for Effective Instruction

It is clear that in respect to these matters the professor must present something more than patterns and forms of thought. While the transmission of forms of thought from one age to another is one of the chief functions of a university, yet a live teaching demands that these forms be clothed with significant data obtained through research activities, and be adjusted to the development of the world about us.

I take it that teachers of highway engineering have sooner or later to discuss the selection of various types of roads to fit specific situations; and also to discuss the factors governing policies in surfacing second-class roads. This discussion must certainly concern itself with the cost of maintenance of the surface. But where are reliable maintenance data? In many cases maintenance charges only indicate that the money came from the maintenance fund, but do not determine its specific use. Extra surface expenses, such as ditching, widening, fencing, and renewal of surface after several years of neglect, may not be included. Likewise the relative traffic on the several roads and the distribution of this traffic throughout the year may not have been measured. The quality of materials and climatic conditions, cost of labor, snow removal, etc., also enter into the comparison; and finally, there is no good measure of the completeness of the maintenance. What is needed is some uniform accounting system for

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Address presented at the Second National Conference on Education for Highway Engineering and Highway Transport held at Washington, D. C., October 26, 27 and 28, 1922.

maintenance costs simple enough to be operated by the ordinary maintenance foreman. Analysis of the data will then permit judgment upon problems confronting highway officials.

The teacher cannot go very far in his discussion without considering the operating cost of the vehicle on the various classes of roads. And when he comes to consider the economics of locations, he will have to present data of fuel consumption on grades, and other operatig expenses which depend on the characteristics of the vehicle, the use of gears, the limit of maximum speed, etc. How far have our friends, the automotive engineers, progressed in this field? Before highway engineering can be taught as a thought developing subject, not only must there be the formulation of thought, but this skeleton must be clothed with information.

How to Serve the Colleges

Of course these data are being gathered more or less slowly in some fields of research and fairly rapidly in others. It appears to me that the Highway Education Board will serve the colleges best by providing some agency to assemble the data from completed and current research, uncover the underlying principles, and prepare a series of brochures for the use of teachers in colleges, supplemented by a supply of lecturers who would present a large view of the problems of the industry of highway transport. Teaching without a basic of scientific information upon which to teach, is not an effective process. Such an agency for this service would be provided with a sufficient corps of competent analysts and be financed on a five years basis.

Research depends upon instruments and upon training in their use. It has been said that the remarkable scientific powers and promise of the Greeks found an early limit to accomplisment through the lack of instruments of precision and the technique of research, and the lack of the spur by which the needs of industry stimulates research. I have been told that the beginning of modern road construction in this country coincided with the return of the late Prof. Shaler of Harvard from France, with certain instruments devised for the testing of road materials, one of which, the Deval machine, was first shown in 1878 at the Paris Exhibition.

The first years of the Massachusetts Highway Commission and the Maryland Highway Commission, both pioneers in scientific highway building, were closely connected with the Lawrence Scientific School of Harvard University and John Hopkins University, respectively, Several of our present day leaders in highway engineering were trained in the staffs of these two commissions. There is, therefore, a close connection between the university and the highway.

Research training in college, or some equivalent, is also valuable in after life in developing a critical faculty in the habit of estimating the completeness of the development of data, or its technical validity, upon which judgment is based, and in the habit of seeking underlying assumptions. A consideration of the industry of highway transport, with its engineering and economic problems fits in very nicely with the courses in engineering administration now operative in so many colleges. Students respond very quickly to a broad presentation of this industry, and I know of no better way to stimulate the interest of the colleges themselves than illustrated lectures in which the technical detail can be forgotten and the high points of the topography pointed out. Students are eager to select fields of future useful service.

Concerning the status of highway research at the present time, I trust I may be allowed to indicate what in my opinion are the most pressing needs:

1. Many problems in highway engineering are accompanied by corrolary problems in economics of highway transportation. For instance: How much can an engineer afford to spend in capital costs of construction in reducing grades? The answer must depend on volume of traffic and on operating costs of road and vehicle. Decisions upon changing second class into paved roads involve cost of road maintenance, tire, gasoline, and repairs and depreciation to vehicle. Reliable data appear to be largely wanting.

The cost of highway transportation reflected in the vehicle greatly exceeds that arising from the road. Great are the possibilities of economics in this industry through research into costs of transportation in the fields of vehicle design and operation. The work of the Bureau of Standards in carburation and on tires is notable. Research activities should be pushed. The reflex action of improved grades, alignment and surfaces on change of design and upon operating costs of vehicle also suggests itself. *It in increasingly evident that the highway engineer and the automotive engineer must join forces in highway research.*

2. The study of methods of financing road construction of various classes, and distribution of expense between those benefited awaits traffic surveys similar to those now under way in Connecticut. The study itself needs the services of trained economists.

3. The laws governing the growth and dispersion of traffic, and the mechanics and psychology of safely handling such traffic in congested areas, need study by research methods.

4. The large volume of valuable data, accumulated at the cost of hundreds of thousands of dollar, at the Bureau of Public Roads, Bates and Pittsburg test roads, and other test roads, in studies of soil properties, strength of slab and effects of loads, that underlies the mechanics of slab design, should be brought together, and analyzed to uncover the principles of action. Then either an engineer can be given the formulas for fitting the road to the load, or final coordinated researches can be planned to settle these questions.

5. The economical life of pavements in given situations must be learned from carefully gathered statistics, so that highway engineer officials may not have to depend upon the views of those urging the adoption of a particular type.

6. The findings of laboratory tests upon materials of construction should be scrutinized in the light of experience in operation to determine to what extent they are productive of the service value of the road.

Assuming that an effective and unbiased organization can be created to supply needed research data to the universities, what can the universities do to actively participate in highway research? It must be realized that universities, are now active, because the Census of Highway Research recently completed by the Advisory Board shows that out of the total number of 475 reported projects, some 189 of these are under way in the universities. The research is carried on in the following fields:

Economics	15
Design (road)	48
Construction	3
Operation	4
Design (vehicle)	5
Materials	114
Total	189

In certain states where the highway commissions have not developed a laboratory or staff to carry on routine tests of materials, this duty is performed by the universities.

Professor Dougherty of the University of Tennessee has done notable service in a study of the highway problems of typical counties in that state. A study of highway policies in improving the roads in a county in the neighborhood of the university is a means of bringing the reality of the whole of the highway problem before the students of the university. The universities are well qualified to do this work. Such data as cost of construction per mile, the cost of advancing the construction to higher classes, study of the soil and topographic features, determination of the maintenance data of existing roads correlated with traffic, analyzed into city and rural vehicles, the determination of the taxable resources of the county, and the effect of highway improvements on land values and community interests,—all of these can be studied by the universities with the help of the students, While the results may not have general application, they will be illuminating and will bring into view the local aspects of highway policies which are often lost sight of. Such studies will form a valuable medium of education.

In particular the Land Grant Colleges of the states are committed by policy and by duty to aid the development of the state's resources and its material welfare. State expenditures in highway construction and maintenance generally from the larger part of the state budget. It would seem that there would be no more effective use of the facilities of the universities in rendering service than by the study of the highway problems of the state.

With respect to the appropriate activities of the state highway commission and the universities, a distinction might well be drawn between those functions which involve routine operations and quick service such as the routine testing of materials for reception under contracts, and research investigations which demand unusual equipment and special training of the experts attached to the university staffs.

It would appear in general to be a misapplication of the facilities and the energy of the university when devoted to the business of routine tests of materials, because the university is uniquely prepared for broader fields of investigation. However, these are expensive tests on a large scale such as the Bates Road and the Pittsburg Road, demanding an investment and continuous service of a large corps of researchers which are clearly beyond the capacity of a university.

Cooperation vs Competition between Motor Truck and Railroad Transportation–I

By W. H. LYFORD

Vice-President, Chicago and Eastern Illinois Railway Co

THE transportation of goods is an absolutely essential requirement for the family, industrial and commercial life of a civilized people. The furnishing of transportation is sometimes considered a function of the government, but the people of the United States will not permit the government to perform transportation, except through the mail service and for packages weighing 70 lb. or less. All other transportation of goods must be performed by the person requiring it, or by a carrier for hire. This discussion will be confined to highway and railway transportation of goods for hire.

Complete Transportation

Transportation is not complete until the goods are moved all the way from the premises of the shipper to the premises of the consignee and, for brevity, we will call such movement "complete transportation." Also for brevity, we will use the Brtiish term "trader," which includes both shipper and consignee, or all persons for whom transportation of goods is furnished for hire.

The trader is concerned only with complete transportation. His greatest need is that complete transportation shall be furnished with regularity and within reasonable time. His secondary need is that the charges which he must pay for complete transportation shall not be more than the traffic will bear, without curtailing his profitable trade.

Complete transportation cannot be furnished regularly and promptly unless the charges of the carrier are high enough to pay all the expenses of carriage and a profit sufficient to warrant the investment of capital and energy in the installation of the transportation service and in increasing the service as traffic increases. In normal times, the volume of freight traffic in this country increases at a rate of not less than 6 per cent per year.

The trader is entitled to the best transportation service which can be furnished for the charges which he pays and it is the duty of carriers who, singly or jointly, undertake to furnish complete transportation, to make their charges as low as is consistent with the maintenance of adequate, regular and prompt service.

We are accustomed to think of the transportation of goods as divided into four general classes: (1) parcel post, (2) express, (3) less-than-carload or package freight (commonly called l. c. l.) and (4) carload freight.

The essential difference between carload and l. c. l. freight is that carload freight is loaded and unloaded on an industry track or a team-track by the trader, or by someone employed by him, while l. c. l. freight is loaded and unloaded and passed through a station, at the expense of the railway. Consequently, carload rates are substantially less per ton than l. c. l. rates, for carrying the same goods.

Collection and Delivery

Whether the government, the express company or the railroad company undertakes to transport the goods, the railway actually performs the entire transportation service, except the movement between the premises of the traders and the stations of the railway companies. Such movement is called "collection and delivery." Parcel post is not collected, but it is delivered by the government. Express is collected and delivered by the express company. Freight is collected and delivered not by the railway company, but by the trader or by the owner of trucks or teams, whom we will call "the trucker."

Because the railway does not furnish collection and delivery and that service must be performed by or at the expense of the trader, the traders have located their industries as close as possible to railway stations. Consequently, the vicinity of the freight station is usually a congested district in any large city. If the railway furnished collection and delivery, the location of the freight stations

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Address presented at the Second National Conference on Education for Highway Engineering and Highway Transport held at Washington, D. C., October 26, 27 and 28, 1922.

would be immaterial to the trader. A distance of two miles between the locations of two stations in a large city may make a difference of 300 per cent. in the interest charges on the real estate occupied by the stations. In Chicago the interest charge alone on real estate at 12th St. on which a freight station is located, is more than $2.50 per ton of freight handled through the station. If the station were located at 33rd St., such interest charge would be reduced to about 80 cents per ton. The amount of interest saved by moving the station to 33rd St. would pay the cost of well-organized cartage between the 33rd St. station and the premises of the trader. The present cartage charges would be saved.

Outbound freight is moved to the station in whatever way and at whatever time the trader chooses, during the business day. Inbound freight is removed from the railway station in whatever way the trader chooses and, on the average, about three days after the freight arrives. Therefore, the station becomes a storage warehouse, congested with piled-up freight awaiting delivery to the trader, at his convenience. With collection and delivery service controlled by or in full cooperation with the railway, large freight stations with storage facilities would be unnecessary. A narrow platform, with a roof over it and with tracks on one side and a highway on the other, is all that would be required.

Storage a Seperate Function

With very few exceptions, railway freight stations in large cities already are so congested that, unless we can find some way to pass more traffic through the existing facilities, or to keep on enlarging and multiplying them, by extravagant expenditures for additional real estate and track connections, the railways will not be able to handle the normal increase in freight traffic.

Railway companies are organized to furnish transportation. Storage is a separate field for enterprise. The public warehouse is needed and should be fostered because it can be operated at a profit. Storage in railway stations rarely is profitable to the railway company and it seriously interferes with the legitimate function of the railway—to furnish transportation.

The fields within which complete transportation of goods can be furnished by highway alone or by railway alone are limited. There are very few industries or residences in continental United States which are not connected with each other by highway, and it is physically possible to perform complete transportation of goods by highway, between almost any two industries or residences. But such transportation is most economical only when limited to the movement of goods between homes or industries which are within reasonable trucking distance from each other. The determination of such reasonable distance depends on many conditions and a competent truck expert will place it anywhere between 25 and 150 miles, of course there are emergencies and peculiar industrial conditions which, in rare cases, make trucking economical over a distance of several hundred miles, but such cases are negligible in the consideration of the whole field of highway transportation.

On the other hand, comparatively few industries and practically no residences are connected with each other by railway. Therefore the field for complete transportation of goods by railway is restricted to the movement of carload freight between these industries which have direct rail connections. In that limited field the railway is the most economical means of transportation. A fair example is the movement of coal from mine to an industry located on a side track.

In this country, four different agencies are competing with each other for the transportation of the same goods: Parcel post, the express company, the railway and the trucker. While the parcel post and express are transported over railways, the government and the express company compete with each other and with the railway for the carriage of packages weighing 70 lb. or less, and the trucker competes with the three other agencies.

Competition for the local carriage of goods within city and suburban areas ought to be welcomed by the railways, as they perform this service at an actual loss, while the trucker can perform it at a profit. On the other hand, competition with the railway for the carriage of goods through rural districts, along mail lines of railway, is harmful to the railway and unprofitable to the trucker.

For parcel post there is complete cooperation between railway and highway transportation, as the government has its own cartage system. There is like cooperation in the express business, as the express company operates its own trucks and wagons. For freight traffic, there is hardly any cooperation between the railway and the motor truck.

I have marshalled the foregoing facts, without any idea that they would be new to you but that they might form a background for the statement: *That unless there is a radical change from present practices in railway transportation in the United States, our great transportation system, which is the wonder of the world, will become a hindrance to the further progressive development of this country.*

Five years ago, when our railway system was placed under Federal control, its march of progress was halted and it has never regained its stride. Its development has not kept pace with the industrial development of the country, because its revenues have not been sufficient to attract the additional capital necessary to finance the cost of normal additions and betterments to road and equipment.

Lower Rates Needed

The public is clamoring for lower rates, while existing rates are not high enough to produce the net railway operating income which, as determined by the Interstate Commerce Commission, the railways are entitled to earn. Still the tendency of the Commission is to reduce rates and there is no reasonable hope of increasing them.

Disregarding the temporarily bad condition of railway equipment resulting from the existing strike of the shop crafts, the only limitation on the volume of traffic which the railroads can move is due to the railway terminal facilities which are inadequate to take care of the traffic which easily could be transported over the main lines of railway.

Under existing rates, the line haul of freight would be highly profitable, if the revenue therefrom were not absorbed by constantly increasing terminal expenses. If the railways are to remain solvent and carry the traffic for which rail transportation is demanded, they must find a way, first, to reduce terminal expenses, the second, either to enlarge their terminal facilities or to pass more traffic through the existing facilities. Now to do these things is in my opinion the most important problem before the American people. I have devoted to it all the time I could spare from my regular duties during the past 15 years, and have arrived at the definite conclusion that the problem can be solved only by remedying the following evils.

First.—Too low compensation paid to the railways for carrying parcel post and express on expensive passenger trains.

Second.—Lack of organized collection and delivery service, which lack makes it necessary to furnish unreasonably large and expensive freight terminal facilities, and an unreasonably large supply of freight cars.

Third.—The use of box cars for the transfer of l. c. l. freight between railway stations in large terminal areas. The trucker could perform that necessary service more quickly and economically. Thousands of box cars thereby would be released from an unprofitable service and would substantially increase the carrying capacity of the railway.

Fourth.—The use of box cars as trap cars, for moving l. c. l. freight through terminal areas for industries which have all connections, and the iniquitious absorption by the railways of trap-car, subway, and lighterage expenses, which is equivalent to furnishing free cartage to the favored few large traders, in discrimination against the average trader, who is obliged to provide or pay for his own cartage.

Fifth.—The operation of branch lines on which the traffic is too light to sustain railway transportation and which could be served better and at far less expense by the motor truck.

Advantages of Cooperation

The most important field for cooperation between the railway and the truck is offered by collection and delivery of l. c. l. freight in large cities. Comparatively few trucks are used in this service, first, because there is no cooperation between the truckers themselves, and second, because there is no cooperation between the trucker and the railway. As the collection and delivery of l. c. l. freight in large cities is now conducted, the delays to trucks in reaching the station door and in loading and unloading the truck, make unprofitable the use of the truck in station service, so that by far the greater part of this service is performed by horse-drawn vehicles. Truck transportation is only profitable when the truck can be kept moving the greater part of the time.

Notable experiments have been tried in the United States for handling the collection and delivery of the freight of one railway company in a large city and, so far as I have been able to learn, none of them have been successful. No single railway company receives and delivers freight from and to every part of a large city in sufficient volume to make profitable the collection and delivery of such freight by a trucking organization. I am satisfied, however, that the combine l. c. l. freight of all the railways reaching a city could be collected and delivered by a properly equipped single trucking organization, working in full cooperation with the railways, at less cost than is now paid by the traders in that city for their cartage, and still yield a reasonable profit to the trucking organization.

For many years, the Canadian railways have furnished collection and delivery in the principal cities of Canada, under separate cartage tariffs. The president of one of the largest Canadian railways is my authority for the statement that his railway could not possibly handle its traffic through its present terminal facilities without well-organized collection and delivery service.

In England, Scotland, and Wales, the railways are furnishing collection and delivery at practically all of their stations. Knowing this, I devoted a few days last year and several weeks this year to intensive study of the collection and delivery service in England and Scotland, principally in the great cities of London, Manchester and Glasgow. I was given exceptional opportunities and assistance for the investigation at close range of the terminal operations of the principal English and Scotch railways. As you perhaps know, the general manager is the chief executive officer of a British railway. The several general managers with whom I discussed these problems in Great Britain were unanimous in expressing the following conclusions:

1. That the collection and delivery of freight, at terminal cities and in large industrial centers, by a single trucking organization, is absolutely essential to the most efficient operation of freight stations and that with such a trucking organization cooperating with it, the railway company may control the time of collection and delivery of freight and is able to operate its stations throughout the 24-hr. day if necessary, and to use the same platforms and forces for handling in-bound and out-bound freight.
2. That collection and delivery can be furnished under a separate tariff at rates high enough to produce an actual profit from the cartage operations, after paying all expenses, and low enough to induce 95 per cent of the traders to avail themselves of the organized collection and delivery service rather than to perform it themselves.
3. That in England, where the general conditions are substantially like those in New England, the railways and the traders have prospered under unified cartage systems, without any substantial additions to station facilities.

In all of these conclusions of the British railway managers I heartily concur and I believe they ought to be adopted by American railways.

Contrast the operations of a large terminal freight station in the United States with a typical British "goods" station. In this country, the in-bound freight is handled over one set of platforms by one working force and the out-bound freight is handled over another set of platforms by another working force. Each set of platforms and each working force is operated through the entire business day, as freight is taken away from the in-bound station, and received at the out-bound station during the entire day. The inbound platform is piled up with freight awaiting delivery, interfering with the movement of freight across the platform. When the in-bound cars are unloaded, they must be pulled out of the station and set into the out-bound station for loading the following day.

The British Method

In a typical British station, the same platforms are used to handle not only the in-bound and out-bound traffic, but also a third class of traffic and they are operated through the entire 24-hr. day. When the day force goes on duty at 8 a. m., a line of cars loaded with in-bound freight is standing on one side of the station platform and a continuous line of trucks or "lorries" are backed up to the other side of the platform. The city is divided into districts and the freight for one district is loaded into one or more lorries, there being more lorries at the platform than there are districts in the city. As soon as a lorry is fully loaded, a driver is summoned by telephone from a nearby stable. He comes with a heavy Clydesdale horse and drives away with a 3-ton load to the proper district, where he makes delivery. When one lorry is loaded and driven away, another empty lorry is backed into its place, loaded and driven away.

Before noon, all of the in-bound freight has been removed from the cars and delivered by lorries. At 1 p. m. the station platform is clear and ready to receive the out-bound freight which is collected and delivered at the station by the same drivers who delivered the in-bound freight in the forenoon. All of the out-bound freight is collected before 5 p. m., loaded into cars and dispatched before midnight. The platform is again clear and ready to receive the heavy fish and vegetable traffic which begins to arrive at 1 a. m. and is delivered at the markets before 6 a. m. At 8 a. m., the platform is again clear and the empty lorries are standing at the platform ready for the in-bound merchandise.

(*To be concluded.*)

Current Events in the Field of Highway Engineering and Transport

American Road Builders Completing Plans for 1923 Convention and Show

The Thirteenth American Good Roads Congress and Fourteenth National Good Roads Show to be held in Chicago, January 15th to 19th next, promises to eclipse by far in program and attendance all previous conventions. Both events will be held under the auspices of the American Road Builders' Association, the largest and oldest good roads organization in the country. Many prominent speakers will attend, including high officials of the Federal Government, several governors, hundreds of state highway officials and mayors of American and Canadian cities as well as thousands of engineers, contractors and good roads enthusiasts.

It is the intention this year to separate the congress and show by holding the former at the Congress Hotel and the latter at the Chicago Coliseum. This arrangement will obviate the necessity of shutting down the operating machinery during the sessions and eliminate the noise that has proved so annoying to speakers and delegates heretofore.

Shortly after his election, Thomas J. Wasser, state highway engineer, Trenton, N. J., president of the American Road Builders' Association for 1922-1923, appointed to the Executive Committee the following: Charles M. Upham, state highway engineer for North Carolina; James H. MacDonald, consulting highway engineer, New Haven, Conn., and J. H. Cranford of the Cranford Paving Company, Washington, D. C. This committee, acting for the American Road Builders' Association, appointed Messrs. Upham and MacDonald, and the Highway Industries Exhibitors'Association designated its president, S. F. Beatty, vice-president of the Austin-Western Road Machinery Company, Chicago, to act as a committee having general charge of the arrangements for both show and congress.

This committee has created several subcommittees to have charge of the various detailed arrangements as follows: Transportation Committee, Royal M. Allen, Chicago, chairman; General Publicity Committee, S. T. Henry, New York, chairman; Chicago Press Committee, W. R. Harris, Chicago, chairman; Exhibitors' Committee, C. R. Ege, Chicago, chairman; Entertainment Committee, A. C. Cronkrite, Chicago, chairman; Reception and Hotel Committee, John B. Hittell, Chicago, chairman; Registration Committee, L. S. Louer, Chicago, chairman; Banquet Committee, Joseph R. Draney, New York, chairman; Program Committee, E. J. Mehren, New York, chairman.

According to President Wasser of the American Road Builders' Association, the chief difficulty will be encountered in providing space for all the exhibits, though arrangements will be made for all the additional space it is possible to obtain. "The Highway Industries Exhibitors' Association," said Mr. Wasser, "is giving us splendid cooperation in working out the arrangements. We expect to conduct a pre-convention campaign of greater compelling force and more far-reaching effects than ever before and I believe the attendance will break all records.

"The program for the congress, as it is being worked out by the Program Committee, will be the exact reversal of our previous ones. Instead of avoiding controversial subjects as in the past the program next year will be made up almost entirely of controversial subjects of interest to the road-building movement as a whole. This, we believe, will greatly increase the interest in the program and will provoke highly interesting and instructive oral discussions from the floor."

IOWA PUSHES LINCOLN HIGHWAY IMPROVEMENT

The work of grading the Lincoln Highway across Iowa is briefly presented in nearing completion and much paving and graveling has been accomplished during 1922. The paved road completed this season from Clinton to Lowden, a distance of 45 miles, from the Mississippi River west, is the start which will ultimately mean a paved highway entirely across a state which, but a few years back, was one of the most difficult states in the Union to traverse by motor.

The present status of the Lincoln Highway across Iowa is briefly preented in the following table:

Paved Streets (concrete, brick, asphalt)	38.5 Miles
Concrete paving	47.9 "
Gravel surfacing	95.6 "
Dirt Grade as yet unsurfaced	197.8 "
Total	379.8 Miles

In addition to the tate work, many of the counties are aiding Lincoln Way improvement. Tama County road supervisors recently let contracts aggregating more than $200,000.00 worth of work, covering grading and bridges. Two bridges comprise $98,000.00 of the total cost of the work in Tama County.

Iowa is getting her large section of the Lincoln Way out of the "gumbo" as fast as is physically possible.

INDIANA TO PAVE LONG STRETCH OF LINCOLN HIGHWAY IN 1923

Concrete To Lead From Ohio Line Through Fort Wayne

Word has been received at the Headquarters of the Lincoln Highway Association here from the Indiana State Highway Commission that it has been definitely determined to include the paving of the Lincoln Highway from the Ohio state line to Fort Wayne and north of Fort Wayne as far as Churubusco in the 1923 program of Federal-Aid road-building which to date comprises 97.5 miles in all sections of the state.

The only paving between the Ohio-Indiana state line and Ligonier at present is that between New Haven and Fort Wayne, a distance of 7 miles, out of the total of 48.

In connecting, with a new concrete road, the town of New Haven and the Ohio state line and the city of Fort Wayne with Churubusco, next season, the state will be making a long step forward toward the final completion of a paved Lincoln Way entirely across the state, for the only unpaved gap at the end of 1923 will be the section between Churubusco and Ligonier, now good gravel.

C. Gray, chief engineer of the Indiana State Highway Department, states that in all probability the new improvement, which will comprise approximately 13 miles of concrete pavement, will be the state's standard 8 in. uniform thickness with 2in. crown and 18 ft. wide. The state estimates the cost of this work at $30,000.00 a mile, or a probable total of $400,000.00.

The decision of the Indiana State Highway Commission follows as a result of the long effort of the Good Roads Bureau of the Fort Wayne Chamber of Commerce, Martin Luecke, Local Consul for the Lincoln Highway Association, Chairman. In its efforts to prove the state authorities the importance of the prompt permanent improvement of this section, the Chamber had the backing of W. G. Zahrt of Fort Wayne, a member of the State Highway Commission, as well as of the County Commissioners. Demonstrating that the Lincoln Highway was the heaviest travelled through route in the state of Indiana brought success to the advocates of the improvement in Allen County. The Federal Government will participate i nthis construction next Spring to the extent of one-half of the total cost.

The state will also next year widen and rebuild the Lincoln Highway between LaPorte and the St. Joseph County line in LaPorte County, a section which is now narrow and in very poor shape.

FOREST SERVICE BUILDS AND MAINTAINS 10,984 MILES OF ROADS AND TRAILS

During the past year the Forest Service of the U. S. Department of Agriculture constructed 724 miles of minor roads at a cost of $540,868 and 2,959 miles of trails at a cost of $519,429. Three hundred and eighty miles of major roads were constructed for the Forest Service by the U. S. Bureau of Public Roads at a cost of $4,620,326. In addition 3,007 miles of major and minor projects were maintained at a cost of $187,162, of which $65,336 was secured from local authorities. Forty-two hundred and ninety-four miles of trails were maintained at a cost of $113,683. This represents a total expenditure for the construction of roads and trails during the year 1921 of $6,456,694, which includes $2,153,522 cooperative funds secured from states and counties.

Expenditures to January 1, 1922, for constructing 3,729 miles of major roads, total $15,301,373, of which $5,681,451 are cooperative funds. Likewise 4,856 miles of minor roads were constructed by the Service at a cost of $2,752,970, including $773,922 of cooperative funds. To date $1,917,169 have been expended in the construction and maintenance of 12,448 miles of trails. The total thus far expended upon equipment amounts to $651,608, while $920,134 was expended upon overhead and administration by the U. S.

Bureau of Public Roads and Forest Service.

To date a total expenditure of $22,216,724 for the construction of 4,786 miles of roads, 6,711 miles of trails and the maintenance of 3,007 miles of roads and 5,737 miles of trails has been made.

NEW BULLETIN ON CONCRETE ROADS

"Portland Cement Concrete Roads," a new publication prepared by the U. S. Bureau of Public Roads, has been issued as Bulletin 1077 of the United States Department of Agriculture. The bulletin is the work of James T. Voshell and R. E. Toms, engineers of the bureau, who have been in charge of a large amount of Federal-Aid road construction and who have had an opportunity of inspecting concrete road construction under a wide variety of conditions.

The subjects discussed are materials used, proportioning, design, construction, organization and equipment, capital required, cost, maintenance, and resurfacing. Particular attention is given to width of pavement on tangents and curves, transition curves, and superelevation. Practical field methods are described and tables and charts given of value to field engineers.

Contractors will be interested in the pages describing operations with various kinds of equipment accompanied by diagrams illustrating organization and plant layout. They will also find use for the table of quantities of materials per mile of pavement for various widths and mixes, data for use in computing the size of engine for pumping water, cost of concrete roads in all sections of the country and a list of the items to be taken into account in estimating costs. Copies may be had free upon application to the Department at Washington, D. C.

Sectional Committee on Colors for Traffic Signals Organized Under American Engineers Standard Committee

Thirty-nine men—representing as many administrative bodies, trade associations, scientific or technical societies; and government departments—make up the Sectional Committee on Colors for Traffic Signals which was organized at a meeting in New York City on November 9 under the auspices of the American Engineering Standards Committee. In opening the meeting, P. C. Agnew, secretary of the American Engineering Standards Committee, said that this was unquestionably the most representative group that has ever come together anywhere in the world to discuss this subject.

The committee elected as its officers the following representatives of the three sponsors for the code: Chairman, Charles J. Bennett, State Highway Commissioner of Connecticut, representing the American Association of State Highway Officials; vice-chairman, Dr. M. G. Lloyd, representing the U. S. Bureau of Standards; secretary, Walter S. Paine, Research Engineer, Aetna Insurance Company, Hartford, Conn., representing the National Safety Council.

Because of the difficulty of bringing the entire sectional committee together at frequent intervals an executive committee was appointed with instructions to collect information on the subjects coming within the scope of the code, to digest this information, to appoint subcommittees, to arrange for the necessary research work, and to draft definite recommendations for the consideration of the sectional committee. The executive committee consists of the following:

Bert Lord, New York State Department of Motor Vehicles, Albany, N. Y. representing the group of administrative officials and departments;
T. D. Pratt, Motor Truck Association, New York City, representing the owners and operators of motor vehicles;
G. G. Kelcey, American Gas Accumulator Company, Newark, N. J., representing the group of automotive accessory, signs, and signal manufacturers;
A. H. Rudd, Safety Section, American Railway Association, representing the railroads;
W. P. Young, general manager, National Automobile Underwriters Conference, representing the group of insurance interests on the sectional committee;
W. P. Eno, of the Eno Foundation, Washington, D. C., representing the group of scientific and technical societies;
Harry Meixell, of the Motor Vehicle Conference Committee, New York City, representing the motor vehicle manufacturers;
and the three officers of the sectional committee.

The sectional committee by resolution invited the Aeronautical Chamber of Commerce of the United States to participate in the work of the committee. It was also decided at the organization meeting of the sectional committee to appoint a subcommittee to investigate the efficiency of all color signals now in use as traffic signals, and where possible to ascertain the reasons for adopting certain colors for specific uses. This committee will investigate the use of various types of semaphores and silent policemen. Another committee will make an original study of specific colors for definite uses as a check upon previous researches and to establish certain colors for traffic signals. A third committee will study non-luminous signs and signals (excluding luminous signals) and propose, after a thorough research, signs of definite colors and shapes for highways and also for railroad crossings.

WINTER WORK WILL SPEED GOOD ROADS IN MINNESOTA

Charles M. Babcock, State Highway Commissioner of Minnesota, has recently announced a program of winter work on the trunk highways covering more than 150 miles of gravel surfacing, some grading improvements and several new bridges. Bids are to be opened Nov. 28 at the rented headquarters of the highway department in St. Paul. Work is to be pushed as fast as conditions will permit under a plant to put the newly improved sections in the best shape by spring, according to John H. Mullen, assistant commissioner and chief highway engineer.

The winter program of highway work is in line with the policy inaugurated a year ago to furnish employment to farmers and teams when it is most needed in many localities. The jobs listed are estimated to take the labor or more than 1,000 men and teams, or proportionate numbers of trucks and drivers, during the greater part of the winter. They are undertaken following showings last winter that road work, notably graveling, can be carried on advantageously and at lower cost than during regular construction seasons.

The gravel surfacing will cover many jobs of new grading, making the latter foundation work which took about 40 per cent of trunk highway construction funds to date more noticeable to the average driver who judges a road generally by the surface and riding qualities. It will practially complete all projects started to date, rounding out road results for the first two calendar years under the Babcock good roads plan.

Four miles of grading with two bridges and numerous culverts on Trunk Highway No. 31 east of Ada, a 35-foot span bridge on T. H. No. 6 west of Ada, and 2½ miles of grading with 3 bridges and several culverts on T. H. No. 12 southwest of Chaska are the special projects. Others are gravel-surfacing improvements with locations and mileages as follows: T. H. No. 2 west of Aitkin, 5 miles; T. H. No. 3 south of West Union, 2½ miles; T. H. No. 4 north of Park Rapids, 9 miles; T. H. No. 8 Grand Rapids-Blackberry, 9½ miles; T. H. No. 8 northwest of Class Lake, 4 miles; T. H. No. 8 southeast of Bemidji, 6 miles; T. H. No. 8 east of Bagley, 3 miles; T. H. No. 10 Benson-Clontarf, 6 miles; T. H. No. 21 St. Peter-Cleveland, 6 miles; T. H. No. 22 Gaylord-Norseland, 14 miles; T. H. No. 23 St. Cloud-Foley, 14 miles.

MISSOURI PLANS FOR AMBITIOUS PROGRAM OF ROAD BUILDING

Since the appointment of the Missouri State Highway Commission special effort has been made to complete the McCullough-Morgan road program provided by the Legislature during the 1919 session, and to start the $60,000,000 bond issue program.

Missouri now has under contract approximately $14,000,000 worth of work, or 1300 miles of improvement, consisting of graded earth, gravel and higher-type roads. The total amount made available for road purposes during the past two years was approximately $18,000,000, of which approximately $6,000,000 was from the state automobile fund, $6,000,000 from the federal government and $6,000,000 from counties of the state that chose to spend their money under state supervision.

There are at present over 225 different road building projects in course of construction in the various counties, and additional contracts are being let each week. A special effort is being made to place all of this work under construction before January 1, 1923, which is in full harmony with the provisions of the law.

The work of the Missouri State Highway Department is now being handled through ten Division Engineers, who have permanent headquarters in different parts of the state. The present plan is to expand each division office so that they can keep in close contact with the projects and thereby insure all work being carried out in full compliance with the plans and specifications.

The Commission is now making extensive plans to place under contract a very large amount of construction work under the $60,000,000 road program. Five million dollars of 4½ per cent bonds have been sold at a premium of $32,000. A letting on September 28 was scheduled under the new program. This first letting was for work in twenty-one counties of the state, aggregating approximately 110 miles and having an estimated value of $1,981,400. Other lettings will follow, so that the full amount of the $5,000,000 worth of bonds which have been sold will be under contract before January 1. Additional bonds will probably be sold by the first of the year, so that contracts can be let in all counties of the state before construction work opens up next year.

DRIVERS NOT ALWAYS RESPONSIBLE FOR HIGHWAY ACCIDENTS, SAYS A. A. A. EXECUTIVE

Jay-Walking Most Serious Menace To Traffic Safety

"The public as a whole is too ready to place the blame for any accident in which an automobile figures on the driver of the automobile", states M. O. Eldridge, Executive Chairman of the American Automobile Association. "The first cry that goes up, as a rule, when such an accident occurs, is that the driver of the car was at fault when as a matter of fact, in a large majority of cases, the person injured was to blame.

"I have before me," continued Mr. Eldridge, " a chart containing a summary of traffic accidents in New York City, with the fault or incapacity of the proper party listed and while perhaps the cause of 50 per cent of the accidents is listed as unknown, the blame in the cases where the fault of the accident has been determined is overwhelmingly placed on the persons injured.

"Over a certain period of time in which 7327 accidents, involving private automobiles, occurred, the police department of New York City find by thorough investigation that in 450 cases the driver of the car was to blame; in 3168 cases the person injured was to blame; and in 3683 cases the cause of the accident was unknown. With the heavy preponderance of blame placed on the person injured in the known causes of accidents, it is but fair to presume that the injured person was to blame in more than 50 per cent of the remaining 3,683 cases, basing this on the most conservative estimates. During the same period of time, in which 1209 accidents, involving taxicabs, occurred, the cause for 51 such cases was traced to the driver while 437 cases were blamed on the person injured and the cause of 714 accidents remained unknown.

"These figures serve to emphasize," Mr. Eldridge continued, "the contention of the A.A.A. that no traffic regulation is complete until it provides a penalty for jay-walking. The jay-walker in my opinion is the most serious menace to traffic safety in the United States today. The automobile has always been a subject of class legislation. It is a shining target for every legislator seeking a new means of revenue. It pays more tax than property of similar value in the world and is subject to more regulations than any other means of conveyance. The American Automobile Association stands for obedience to the law and for observance of all traffic regulations, but we feel that if a motorist is to be fined for disobedience of a traffic signal, then the pedestrian should be fined for jay-walking across the street, putting himself, as well as every motorist, in that immediate vicinity in danger.

"The automobile has done more to enhance man's value to his community and to enhance the value and enlarge the scope of that community than any other one invention and we respectfully maintain on behalf of the motorist that the automobile driver is entitled to much more consideration than he now receives."

KENTUCKY HIGHWAY DEPARTMENT SHOWS RAPID GROWTH

According to a recent report of the Kentucky Department of Public Roads and Highways made by State Inspectors and Examiner Henry E. James. Expenditures of the Kentucky State Department of Roads and Highways for the past two years beginning July 1, 1920, and ending June 30, 1922, amounted to $10,231,273.40, as compared with $2,498,299.44 for the previous two years. In 1920 the Department had expended a total of $567,034.04 in federal aid work and during the past two years the money expended along this line increased to $6,714,168.49. The total receipts of the department for the last two years were $9,722,962.42, or $508,310.98 less than the expenditures.

During the past two years 406.55 miles of road were repaired and accepted by the state; 56.38 miles were completed by state aid, 51.72 miles completed by convict labor; 205.12 miles completed by federal aid, and 88 miles taken over for reconstruction, making a total of 807.77 miles of road worked under the supervision of the department. The mileage of road under construction at present is 347.1.

The increase in the amount of money received and expended, Inspector James said, necessarily increased the volume of work done by the department, which in turn increased the number of employes. For instance, he said, the payroll of the department for June of this year, not including field engineers or resident engineers, amounted to $11,977.32. The field and resident engineers are employed on practically all projects under construction which are handled directly by resident engineers who report to and receive instructions from the division engineers. These engineers receive from $150 to $200 a month.

In order to compete successfully with other states securing and holding men of the qualifications and experience necessary, Inspector James said he was informed by the state highway engineer, that it has been necessary to increase the salaries of many of the employes of the department. The Legislature of 1920 increased the salary of the state highway engineer from $3,000 to $5,000 a year. Other increases in salary are road engineer from $225 a month in 1920 to $350; assistant road engineer from $175 to two assistants at $308.33 each; bridge engineer from $225 to $308.33 with two assistant engineers at $250 each; division engineers from $175 to $275. A general inspector and a chief locating engineer have been added since 1920 at salaries of $275 a month each.

Simplified Paving Brick Practice Recommended Bureau of Standards

A short paper which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c. per copy, contains the unanimous recommendation of the joint conference of representatives of manufacturers, distributors, users, and the United

The object of this recommendation is to eliminate economic waste caused by the excessive variety of types and sizes of paving bricks and shows the procedure used in reducing the varieties from 66 to 7.

States Department of Commerce as regards the reduction of the types and sizes of paving brick to the following standard sizes and varieties:

Width Inches	Depth Inches	Length Inches	Width Inches	Depth Inches	Length Inches
Standard Sizes					
3	4	8½	3½	3½	8½
3½	4	8½	3½	3	8½
Standard Varieties					
Plain Wire-Cut Brick (vertical fiber lugless)			Repressed Lug Brick		
3	4	8½	3½	3½	8½
3½	4	8½	3½	4	8½
Vertical Fiber Lug Brick			Wire Cut Lug Brick (Dunn)		
4	3	8½	3½	3	8½
4	3½	8½	3½	3½	8½
...	...	...	3½	4	8½
Hillside Lug Brick (Dunn)			Hillside Lug Brick (repressed)		
3½	4	8½	3½	4	8½

OFFICIAL PROPOSALS

HIGHWAY WORK

Notice to Contractors

ADVERTISEMENT FOR BIDS

SEALED PROPOSALS will be received by the State Highway Department, at its office, Dover, Delaware, until 2 o'clock P. M., December 13, 1922, and at that place and time publicly opened, for the construction of State Highway work, involving the following approximate quantities:

CONTRACT RW-1

Wall on Philadelphia Pike

750 cu. yds. Excavation
700 cu. yds. Cement Rubble Masonry

Performance of contract shall commence within ten (10) days after execution of the contract and be completed on or before April 1, 1923.

Monthly payments will be made for 90 per cent of the construction completed each month.

Bidders must submit proposals upon forms provided by the Department.

Each proposal must be accompanied by a surety bond, certified check, or money to the amount of at least ten (10) per centum of the total amount of the proposal.

The envelope containing the proposal must be marked "Proposal for the Construction of State Highway work under Contract No. RW-1.

The Contract will be awarded or rejected within twenty (20) days from the date of opening proposals.

The right is reserved to reject any or all bids.

Detailed plans may be seen and index plans and specifications may be obtained upon deposit of ten dollars ($10.00) which amount will be refunded upon return of plans and specifications in good condition at the office of

STATE HIGHWAY DEPARTMENT,
Dover, Delaware.

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892
E. L. POWERS, Editor
E. W. TREE, Managing Editor

Vol. LXIII NOVEMBER 29, 1922 No. 22

TABLE OF CONTENTS

Cooperation xs. Competition Between Motor Truck and Railway Transportation 185
By W. H. Lyford

The Trend in Highway Engineering Education . . 187
By T. R. Agg

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPIRTATION

Lincoln Highway Through Traffic Breaks All Records in 1922 189

Proposed Highway Legislation in North Dakota 189

Montana Building Large Good Roads Mileage . 189

Road Materials Research Work Extended at Public University 189

Iowa Road Builders on the Home Stretch for the 1922 Construction Season 190

The Institution of Municipal and Country Engineers to Restrict Admission to Membership After June, 1923 190

Length of Working Season Big Factor in Road Building 190

Little Falls, Minn, Celebrates Opening of Paved Road 190

United States Good Roads Association to Hold Convention in April 190

Selecting The Federal Aid System 190

Minnesota State Highway Department Will Recommend New Bond Issue to 1923 Legislature 190

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At left: Washington Heights, maintained with "Tarvia-B" since 1916.

Above: Du Bois St., maintained with "Tarvia-B" since 1916.

Below: Benkard Ave., maintained with "Tarvia-B" since 1913.

"Tarvia-B" makes good at Newburgh—

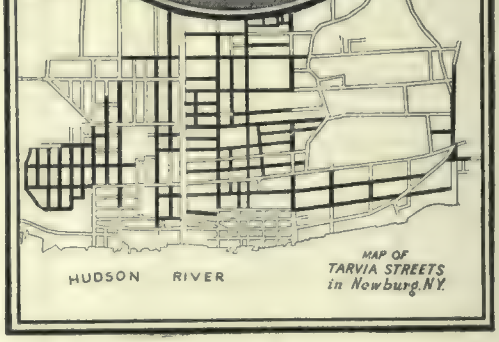
Benkard Avenue, pictured in the circle, was the first Tarvia street in the City of Newburgh, New York. It was treated with "Tarvia-B" in 1913, and again in 1914 and in 1915.

The results were so satisfactory that in 1916 other macadam streets were given their initial Tarvia treatments, and the list has been growing ever since. Not until last year, however, when the 18 miles of roadway shown on the accompanying street map were surfaced-treated with "Tarvia-B", was the use of all other kinds of road-maintenance materials entirely abandoned in favor of Tarvia.

Describing Newburgh's experience with Tarvia, Mr. W. J. McKay, City Manager, wrote under date of March 17, 1922:

> "It is with a great deal of pleasure that I inform you that the results obtained from the use of your 'Tarvia B' on the streets of this city last season were more than satisfactory.
>
> "While we are always in the market for material cheaper than the material we used the preceding season, it would take a considerable difference in price to have us make any change in the product to be used for the season of 1922."

Economy must be the goal of every conscientious public official. And officials of Newburgh, and hundreds of other cities and towns throughout the country, have found from experience that Tarvia is the most economical of all road materials. Some others may be a little cheaper *per gallon* but the small difference in first cost is much more than offset by the big difference in the result obtained.



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Youngstown	Toledo	Columbus	Richmond		Latrobe	Bethlehem	Elizabeth	Buffalo
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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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Cooperation vs. Competition between Motor Truck and Railroad Transportation–II*

By W. H. LYFORD

Vice-President, Chicago and Eastern Illinois Railway Company

FOR the collection and delivery in the country, demountable truck bodies, trailers or semi-trailers doubtless would be used instead of the British lorries and gasoline or electric tractors would be substituted for Clydesdale horses. On our station platforms, we doubtless would use 4-wheel trailer trucks drawn by electric tractors instead of the old-fashioned 2 wheel trucks which are used in Great Britain. In fact, I left that country with the firm conviction that with our American methods applied to the British system of collection and delivery, much greater efficiency would be obtained and better service would be rendered than is now rendered in Great Britain.

Three of the great English railways have combined their collection and delivery service in London with most satisfactory results and I was assured by the manager of the combined service that, if all of the railways reaching London would join in the combination, he could effect even greater economies that he had already accomplished

I am well aware that the average railway manager in this country fears to encourage the establishment of collection and delivery service because of the danger that the railway will be required to pay the cost of the service and thereby increase the terminal expenses. I would not recommend that the collection and delivery service be forced upon the trader, but rather, that it be offered to him under separate cartage tariffs at rates which would be less than the trader's present cartage expenses. I believe that the results would be the same as it has been in Canada and Great Britain where the collection and delivery service has been accepted voluntarily by a large majority of the traders.

Collection and Delivery of Car-load Freight

There is a second field for cooperation between the motor truck and the railway, which would require a more radical departure from present methods than the one just mentioned, but which would produce even more beneficial results to all parties concerned. It is the organized delivery of carload freight from public team trucks in large terminal areas.

As already stated, this freight is now loaded, unloaded, collected and delivered by the trader, or at his expense. In different cities the trader is allowed from 2 to 5 days within which to unload cars after he has received notice that they are ready to be unloaded.

Generally speaking, there is a shortage of team trucks in the central districts of large cities and it is next to impossible for the railroads to furnish additional team tracks. Cars must be held in the outer yards until there is room for them on the team tracks, and then they must be held on the team tracks until it is convenient for the trader, or his trucker, to unload them. The necessary consequence is that large terminal districts are full of idle cars, and I think it is safe to say that the average time that box cars are delayed at the Port of New York and in the switching district of Chicago is 10 days per trip. If all of the freight cars which carry loads into the Port of New York, the switching district of Chicago, and other large terminal areas, could be unloaded on the day of their arrival, they could be loaded out on the same day, or the following day, and the present freight car equipment of the railways would be sufficient to meet all transportation needs for several years to come.

The Results of Competition

Competition between the railways to outdo each other in affording privileges to the traders has brought about a situation which is crippling the freight car supply and thereby is injuring the trader more than he is benefited by the allowance of an unreasonable time within which to load and unload carload freight.

At the present time there is a serious shortage of freight car equipment, in all parts of the country. The railways the commercial organizations and public authorities are urging the traders everywhere promptly to load and unload cars in order to reduce the idle time of freight cars and supply the crying need for more cars to move accumulated freight. Notwithstanding these appeals, the car shortage is not being substantially remedied.

In my judgment, a new system of delivering carload freight must be adopted and it will require the cooperation not only of the railways and the truckers, but also of the traders, warehousemen, the Interstate Commerce Commission and the State Utilities Commissions.

The rules relating to free time for holding loaded and empty cars, awaiting the convenience of the traders, should be so modified as to insure the unloading of cars within 24 hours after they are ready for unloading and the loading of cars within 24 hours after they are placed at the disposal of the trader.

I realize that this is a radical change and would deprive the trader of a substantial amount of free storage which he has always enjoyed and would require him to pay warehouse charges on such in-bound freight as he is unable to receive on the day of its arrival. This apparent disadvantage, however, could be, to some extent, offset by cheaper cartage furnished by an organized collection and delivery service and the warehouse charges might be reduced substantially by cooperation between the railway, the trucker and the warehouseman.

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*Continued from November 22 issue of GOOD ROADS.

The importance of cutting down the idle time of cars is shown by the fact, which I believe can be established, that the average time required by a freight car, in carload freight service, to make a round-trip is about 20 days, and of that time, the car is actually moving in line haul, loaded or empty, only 2 2/10 days, and it is actually earning revenue only 1½ days out of the 20 days required for the round trip.

Branch Line Service

Another field for the profitable use of the motor truck is the transportation of freight between communities which are served by branch lines of railway, on which the traffic is too light to pay the expenses of any kind of railway transportation. Such branches are almost innumerable and are scattered over every part of the country. They were built before motor transportation was perfected and, undoubtedly, they have performed a necessary public service, but they have outlived their usefulness. The transportation furnished over such lines could be performed better and more cheaply by motor conveyances over the public highways. No more such branch lines ought to be or will be constructed, if the trucker will take over the field and occupy it intelligently and efficiently. In recent years, I have known of several cases where railways seriously have contemplated the construction of branch lines, to reach small cities and towns, and, on investigation, have found that they could better afford to establish their own truck service, and the proposed branches have not been built. I will go further and state that I think that all such money-losing branch lines, among which transportation by truck over existing highways could be furnished at less expense, should be abandoned. The better and less expensive truck service should be substituted by the railroad company, if the trucker will not occupy the field.

Who Will Benefit Through These Changes

Five parties are interested in bringing about the chang we have outlined:

1. The whole public would be benefitted in that the city streets would be relieved from the congestion caused by wagons and trucks carrying small lots of freight to and from the railway stations. The new rural highways would last longer, as the cooperation of railway and truck would put an end to long-distance trucking.

2. The trader would get better service at less cost.

3. The motor-truck industry and existing cartage companies and private truckers who would cooperate with the railways would vastly increase their field for profitable operation.

4. The warehousemen would profit by the additional storage now furnished by the railways.

5. The railways would cut down their terminal expenses and would increase their capacity for service.

The trucker has a distinct advantage over the railway, in that highways are constructed by the general public, through some form of taxation, while the railway is constructed at the private expense of the railroad company.

In the early history of this country, public lands and moneys were contributed to a few railway companies, to induce them to build railways in territory which greatly needed transportation, but such donations have long since been repaid by the enhancement in the value of the taxable property, whose development has followed the railroad and would not have occurred without the railroad.

The railway, through taxation, pays a large share of the cost of constructing and maintaining highways, while the trucker pays no part of the cost of constructing or maintaining the railway. If the trucker is to compete with the railway, either he should pay a substantial part of the cost of constructing and maintaining the highway or the railway should be relieved of taxation for highway purposes.

If, however, the trucker, first, would perform that part of transportation furnished by the railway at an operating loss and on which the trucker could make a reasonable profit; second, would cease to compete with the railway for the traffic which the railway can carry at a profit and on which the profit of the trucker is very doubtful; and third, would cooperate with the railway in handling traffic which requires transportation both by rail and highway; in other words, if the truck would supplement the railway service instead of competing with it, then it would be to the interest of the railway that the expenses of the trucker should be reduced to the lowest possible limit, and, in my judgment, the railway could well afford to pay substantial taxes for highway purposes and to make no objection to the free use of the highway by the trucker.

There is a steady and, for the trucker, an alarming growth of public sentiment in favor of imposing upon the trucker a more substantial part of the cost of maintaining and renewing public highways, which, it is claimed, are destroyed by heavy trucks almost as fast as the highways can be constructed. If the public were satisfied that the truck was only used as a common carrier where the railway could not furnish as good and as cheap a service as the trucker furnishes, I believe the public would cease demanding that greater burdens be placed upon the trucker, which would increase the cost of his service.

No Single Solution Possible

No single scheme of operation will fit all terminal situations. The situation at the Port of New York seems to me to demand the use of motor trucks with demountable bodies or trailers to move the freight by way of ferries and city streets between railway terminals on the New Jersey shore and inland off-track stations in the different industrial centers of New York. The movement across the rivers is now made principally in freight cars on car floats. By the use of ferry boats and inland off-track stations, the railroads would be able to release large holdings of very valuable dock property on both sides of the rivers and such property would become available for the docking of ocean steamships for which there is great demand.

The inland stations could be constructed on much less valuable property, and if used as universal stations for all railways and steamship companies, they would offer superior advantages for upper floors which could be devoted to warehousing or other industrial purposes. I have been assured by New York real estate men of great experience that they would undertake to secure sites for such inland stations in all parts of New York and the construction thereon of buildings in which the first floors would be adapted for use as railway stations. They were willing to guarantee that the station floors would be leased permanently to the railway companies at nominal rentals on condition that the occupants of the upper floors might have access by elevators to the station floor for the receipt and delivery of freight without any expense for cartage.

All this traffic now passes through the streets of New York. An organized truck service would substantially reduce the number of vehicles on the streets and the cost of the service would be much less than the expense of the present car float operations.

The situation at Chicago is more complex. The distances are so great and the railway systems so completely covers the city that I think the railways must supplement the truck service for movements over long distances.

In Cincinnati, an organized truck service is in operation and conducts most of the transferring of freight between the city stations of all the railroads centering there. All stations are equipped with necessary machinery for handling loaded and empty 5-ton, demountable, truck bodies, which are loaded and unloaded on the station platform and promptly moved by chasses, under the control of a truck dispatcher. This station to station service could easily be extended to the various industries. In fact, some of the largest traders in Cincinnati already have requested such extension service.

At St. Louis, organized motor truck service with trailers and semi-trailers has long been in operation between the freight stations at East St. Louis and inland stations in St. Louis. The service conforms closely to that outlined for the Port of New York, except that the trucks cross the river on high bridges instead of ferry boats.

At St. Paul and Minneapolis, the Greath Northern and Northern Pacific railway companies for many years have used large box cars as freight stations for out-bound l. c. freight in different parts of both cities. When the cars are loaded, they are switched to a common transfer station, about half way between the Twin Cities, and there the freight is transferred from the station cars to line cars for any destination on either railroad.

The Chicago, Milwaukee and St. Paul Railway Company is using a similar service at the Twin Cities. The president of the latter company, several years ago, assured me that, by substituting that service for the separate stations previously used in each city, his company had been able to move its increasing freight traffic with 40 per cent less cars than previously were required for movement from separate stations in each city.

I believe that for every city there is a practical solution which, with the full cooperation of railways and trucks, would result in the movement of freight through the city stations as soon as it arrives there and would thus enable the railway to furnish much more transportation service without increasing its facilities and without increasing its charges for transportation.

The truck should supplement the railway and not compete with it wherever complete transportation can be furnished by the truck more efficiently and cheaply than by the railway, the truck should be used. Wherever the railway service is adequate and profitable and less expensive than truck service, the railway should perform the service. Where the best and cheapest service can be furnished profitably by the railroad and truck combined, the railway and the trucker should cooperate in furnishing it.

The Trend in Highway Engineering Education*

By T. R. AGG

Professor of Highway Engineering, Iowa State College.

PRIOR to the year 1910, highway engineering instruction in Amercian colleges and universities was confined almost entirely to the conventional course in roads and pavements. A few institutions included in the instruction in surveying, a few problems in highway or street surveying. In general, there was no attempt to differentiate highway engineering from general civil engineering. A notable exception existed at Harvard, where the late Dean Shaler introduced a few elective highway courses in the civil engineering curriculum. Several engineers, who now hold positions of the highest responsibility in the highway engineering field, received their training under Dean Shaler.

The Growth of Highway Engineering

The reason for the relatively meager treatment of highway engineering, during the period prior to 1910, was that the highway problem was principally one of providing for horse-drawn traffic. While there had developed a considerable volume of motor traffic by the year 1908, the percentage of such traffic was small and did not constitute the controlling element in highway design or maintenance.

The rapidity with which the motor vehicle increased in popularity during the period beginning in 1908 was entirely unexpected by highway officials and adequate maintenance developed slowly. In consequence many miles of what had been considered substantial roads, were seriously damaged before steps could be taken to provide suitable maintenance. An enormous maintenance problem therefore developed within a period of five years, and personnel for supervising the work had to be assembled and trained. Along with the necessity for maintenance, there developed an insistent demand for better road surfaces than could be provided by reconstructing existing roads and for great extensions of the mileage of surfaced roads. These demands necessitated the employment of personnel technically qualified to supervise the construction of high class types of road surfaces.

By the year 1922 engineering schools had begun to react to the demand for engineers, prepared for highway engineering, by increasing the amount of highway instruction included in curricula. Since that time the importance attached to highway engineering instruction has steadily increased despite the constant debate on the desirability of permitting specialization in civil engineering. It is doubtless true that the opposition to the inclusion of strictly highway engineering subjects in the civil engineering curricula arose from opposition on the part of educators, who feared a loss of prestige for some of the older established lines of civil engineering, or who doubted the wisdom of including options in the couse of study.

The Present Status of Instruction

A survey of the present status of highway engineering instruction, in the various engineering schools, indicates that three general plans are being followed:—

1. A certain amount of general highway engineering instruction is given through the medium of a course of the nature of the old standard one in "Roads and Pavements", the amount of such instruction varying from two semester hours to five semester hours. It appears that a considerable number of institutions follow the plan.

2. A limited number of schools offer a four years course in highway engineering carrying a B. S. degree. Obviously such a course includes many subjects that are usually included in civil engineering.

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*Presented at the Second National Conference on Education for Highway Engineering and Highway Transport held at Washington, D. C., October 26, 27 and 28, 1922.

3. Many schools inclde a definite amount of required highway engineering instruction in the civil engineering course and then offer a certain additional number of subjects as options open to senior students. The amount of required work varies from three semester hours to eight semester hours and the amount of optional work varies from three semester hours to six semester hours.

Typical required courses are: Roads and pavements, highway design, road materials testing and highway bridges design.

Typical optional courses are: Highway administration, highway drainage, highway specifications and highway finance. In some schools, certain of the courses listed above as required are optional and likewise some of the courses listed as options are required, but the usual arrangement is as indicated.

The content of the several courses of study seems to vary considerably but the following will indicate in a broad way the usual character of the subject matter.

Roads and Pavements: Types of roads and pavement surfaces, methods of construction and maintenance, elements of design and fundamental economic considerations.

Highway Designs: Problems involving the actual working out of designs for roads and pavements, including establishment of grades, alignment and slab thickness and design of such details as curves, intersections and warped surfaces.

Highway Drainage: Application of the theory of land drainage to highway drainage and consideration of the various accepted methods of highway drainage.

Highway Bridges: Application of the principles of structural engineering to the design and culverts for highway loading consideration of the types of structure usually adopted for highway improvements.

Road Materials Testings: Laboratory work, covering the accepted methods of testing non-bituminous and bituminous road materials. Sometimes supplemented by lectures and recitations intended to emphasize the significance of the results of the tests.

Highway Administration: Highway laws, highway finance, methods of administration, organization of municipal and State highway departments and day labor or contract construction organization.

Highway Specifications: Critical analysis of current specifications for road or pavement construction and practice in the writing of specifications for specific projects.

Highway Finance: Usually taught by the department of economics as an exposition of the principles of public finance.

Short Courses in Highway Engineering

In order to bridge over the period during which an insufficient number of properly trained men are available for highway work and to enable ambitious men to prepare themselves for advancement, some institutions give intensive instruction in highway engineering during periods of two or three weeks Courses of this character meet a real need and when the subject matter is well chosen and presented with a regard to the limitations of those in attendance, are of great value. They must be intensive, not too highly technical and must be closely correlated to current highway practice in the area from which the students are drawn.

A few institutions offer graduate instruction in highway engineering and this field probably is susceptible of considerable development Under the most favorable conditions it is impossible to go very far into the ramifications of highway engineering durin gthe under-graduate years nor is it probably wise to attempt to do so. Highway research is beginning to receive the deserved attention and presents a virgin field for graduate study. It, therefore, follows that highway engineering graduate work should for many years to come offer an attractive field for engineers who wish to avail themselves of the undoubted advantage that accrues from graduate study.

In order to make available to practicing engineers the opportunity for graduate study, some institutions offer the graduate work during a period of six or eight weeks during the winter. This enables engineers to attend during what is usually their slack season. But in any case the graduate courses should be available during the regular collegiate year.

Results and Probable Developments

From time to time various organizations engaged in the promotion of highway improvement have urged the educational institutions will de well to plan to meet this need highway work There is ample evidence that the requirements for success in the highway engineering field will become more rigid as practice conforms to the underlying basic principles involved. This is indicated by the fact that notable progress has been made in the science of road building since trained engineers have been placed in responsible positions.

The conclusion is reached that the road building program of the United States will require a large number of new engineers annually for many years and that the field is a promising one for ambitious men. Consequently, educational institutions will do well o plan to meet this need for properly trained men.

The trend in highway engineering instruction seems to be toward a system whereby certain fundamental courses are required of all civil engineering students. In general, this amounts to about five semester hours. Supplementing the required work there is offered about an equal amount of optional highway engineering instruction for men who wish to specialize in the subjects.

It seems to be assured that the need for additions to the supply of trained highway engineers will continue for a long time.

Short courses to fill a present need have been successful in many institutions and may extend through a week or through as many as three or four weeks.

Graduate work in highway engineering is being developed rapidly and affords a real opportunity for educational progress.

''Motor trucks need mirrors as they travel at a slower rate of speed than passenger cars, and the noise of the engine completely drowns out, in many instances, the horn of the motorist behind, who is blowing for the road,'' said Mr. Eldridge. ''Often they will swerve about the time the passenger car is about to pass, and this means an accident. As for the light on a horse drawn vehicle, the need for it is obvious, as a motorist, coming up behind such a vehicle and perhaps blinded by the headlights of a car coming from the opposite direction, cannot see the horse drawn vehicle until he is right on it. I believe that uniform state laws on these two subjects will go far toward decreasing the number of accidents which take daily toll of life, and the A. A. A. will do all in its power to aid in obtaining such laws.''

In mileage of Federal-aid roads under construction Texas is first with 1,408 mi., Nebraska second with 970 mi., and Iowa third with 945 mi.

Texas and New York are the states which receive the largest allotments of Federal aid for highways, which is distributed on the basis of population, area, and mileage of rural highways.

In August Missouri placed 126.7 mi. of new Federal-aid work under construction.

Current Events in the Field of Highway Engineering and Transport

LINCOLN HIGHWAY THRU TRAFFIC BREAKS ALL RECORDS IN 1922

General Condition of Cross-Country Road Now At Its Best—Few Rough Stretches East of Salt Lake City

Transcontinental travel on the Lincoln Highway broke all records during the touring season now closing. This is the report which comes into the Headquarters of the Lincoln Highway Association here from all points along the route west of Chicago where accurate records have been kept.

Official observers stationed on the Lincoln Highway in Central Nebraska by the Nebraska State Highway Department checked all traffic during the week of August 20th-26th, inclusive, and reported a total of 8,438 vehicles for that period, this being a heavier traffic than that observed at any other of the 18 points on the main roads in the State of Nebraska where the traffic was checked.

At the Touring Bureau of the Utah State Automobile Association in Salt Lake City, Utah, 6,067 cars were actually registered during the first ten months of the year as arriving over the Lincoln Highway, 5,161 arriving from the East and the balance from the West. It is very conservatively estimated that only one out of four tourists arriving in Salt Lake City actually register at the Bureau, which would make the total traffic during the first ten months of 1922 through Salt Lake City on the Lincoln Highway total 24,268 cars.

Estimates at Reno, Nevada, place the number of tourists arriving in the Nevada metropolis this season, over the Lincoln Highway, at from seven to ten thousand. A large part of the traffic reaching Salt Lake City turned south there for Los Angeles.

A. F. Bement, Vice-President of the Lincoln Highway Association, who recently completed a fast inspection trip over the Lincoln Highway between Detroit and San Francisco in the Association's official Studebaker Big Six, points out that one reason for the tremendously increased volume of traffic over the Highway this year is the excellent condition of the route between New York City and Salt Lake City, Utah. This 2,400 miles of the great memorial road is rapidly approaching connected completion, according to Bement, who followed a 250-mile-a-day schedule across Indiana, Illinois, Iowa, Nebraska and Wyoming without difficulty.

"There is not at this time 150 miles of the Lincoln Highway between the Hudson River and Salt Lake City which cannot be comfortably driven at 35 miles an hour," said Mr. Bement upon his return to Detroit from San Francisco, "and in that 150 miles are included the detours necessitated by construction under way." The Association's report on the present condition of the Lincoln Highway indicates that the transcontinental tourist of 1923 can anticipate a dry weather boulevard from Chicago to Salt Lake City. The dirt grades in Iowa and Nebraska are slippery and slow when wet, but dry quickly and are kept smooth. The Lincoln Highway from New York to Chicago will have but one 40-mile section of dirt road next season, that being in Pennsylvania, west of Pittsburgh.

Contracts closed between the Nevada State Highway Department and the Lincoln Highway Association assure the completion of the road across Nevada by the first of June, 1924. "The only real barrier to a still greater flow of through traffic across the Continent," said Mr. Bement, "is the great Salt Lake Desert in Western Utah, which our Association has been endeavoring to bridge for the past five years. The Goodyear Cutoff constructed in 1918, with funds contributed to the Association by the Goodyear Tire & Rubber Company and Mr. F. A. Seiberling, then President of the Association, carried all of the transcontinental travel this year, but is rapidly being destroyed through lack of maintenance by the State of Utah. A very large volume of the through traffic reaching Salt Lake City is diverted from the Lincoln Highway there, because of the condition of the desert road, into Southern California over the Arrowhead Trail."

PROPOSED HIGHWAY LEGISLATION IN NORTH DAKOTA

J. E. Kaulfuss, secretary of the North Dakota State Good Roads association, is authority for the statement that the legislative program of that organization will consist of a proposed constitutional amendment and two bills. One of the latter provides for a state highway commission with more power and the other provides state funds with which to meet federal aid.

After 1926, say the requirements of the recent federal aid law, county funds cannot be used, as at present, to secure federal aid and states must have adequate highway departments and provide state funds to match federal aid.

The North Dakota State Good Roads association plans to derive state funds for federal aid from slightly increased auto license fees, despite which, the new schedule of auto fees will be less than taxes on autos would be if the latter were on the taxable list.

Another feature of the proposed plan is that counties will be reimbursed in ten annual installments for the money they have put or will put into state highway projects. Former Lieutenant Governor A. T. Kraabel, Clifford, N. D., is chairman of the legislative committee of the association.

MONTANA BUILDING LARGE GOOD-ROADS MILEAGE

The United States Department of Agriculture states that at the end of the year 1914 Montana had 609 miles of improved roads; and that by the end of the year 1918 this mileage had been increased to 900 miles. The term "improved roads" as here used does not include the earth road grading as ordinarily performed with a blade grader.

Since 1919 and to September 1, 1922, contracts have been awarded by the state highway department for 815 miles of improved roads in 35 counties, the final contract cost of which was $8,371,346.35—the amount of federal aid being $4,587,-341.66.

ROAD MATERIALS RESEARCH WORK EXTENDED AT PURDUE UNIVERSITY

Experiment Station Co-operates With U. S. Bureau of Public Roads In Important Tests

An agreement between the U. S. Bureau of Public Roads and the Engineering Experiment Station of Purdue University has been reached whereby the two shall co-operate in research work of value in connection with the building of public highways. The heads of the parties to agreement are Thos. H. MacDonald, chief of the U. S. Bureau of Public Roads, and Dean A. A. Potter, director of the Purdue Engineering Experiment station. The character of the investigations and research work, according to agreement, shall be conducted co-operatively under the direction of these two men.

The investigation and research work will embrace three main projects, the total estimated cost of these plans amounting to $15,000. The government has assumed the responsibility of employing a proportionate share of necessary assistance for conducting such investigations as are agreed upon, and to furnish at its expense special apparatus that may be required. The government has assigned two engineers to co-operate in the research work, devoting their full time to it.

The first of the three projects is really a continuation of one now being conducted at Purdue University. It consists of the ball test of mortar and concrete. The total estimated cost of the project is $2000 and the cost during the fiscal year 1923 is $560. Three months is required for the completion of this scheme, it being in progress now.

The second project, also in progress at present at the Purdue Engineering Experiment station, takes up fatigue tests of mortar and concrete. The total estimated cost is $6000 and the cost for the fiscal year of 1923 is $4610. The estimated duration of the project is 1 year for completion.

The third supplement to the agreement takes up static load tests of concrete road slabs. The estimated length of this project is 1 year and the total estimated cost is $7000. The estimate of the cost during the fiscal year 1923 is $5000. The purpose of this great project is to study the strength and distribution of stress in differently designed concrete road slabs.

The Purdue Engineering Experiment station will assume direction of the experiments as outlined, Dean Potter and Prof. R. B. Wiley, head of the School of Civil Engineering, leading the work. However, designated representatives of the U. S. Bureau of Public Roads will have free access at all times to the tests, notes and results of the investigations. The Purdue Engineering Experiment station will furnish all ordinary machinery and apparatus not otherwise specifically provided and also all materials, light and power for making specimens and conducting tests in general, except in the case of large field specimens which will be covered by supplementary agreement.

IOWA ROAD BUILDERS ON THE HOME STRETCH FOR THE 1922 CONSTRUCTION SEASON

Construction Records Show Nearly 1 Mile of Paving, 2 Miles of Graveling, 7 Miles of Road Grading and 3 Miles of Tiling Being Completed on Primary Road System Every Working Day

With the end of the season rapidly approaching, every Iowa road builder on the 145 active working projects in the 78 counties engaged are bending every effort to move every yard of dirt, lay every foot of tile, and place every yard of paving possible, before freezing weather puts an end to the 1922 season's work or adds its difficulties to such work as can be carried on in cold weather. Every day and every hour of sunshine means thousands in the pockets of the contractors and more miles of road work to the people of Iowa.

On paving jobs there has been some delay because of lack of materials, not so much because of shortage of material as of shortage of means of transportation of the material. Quite a good many days have been lost because material could not be gotten to the builders even though it was ready for shipment or somewhere on the way.

Every effort is being made to get all the paving contracts finished according to program. Contractors are being urged to use every possible effort to get their work as far along as possible, and on the whole, it now appears that the record for 1922 will come very close to getting the full expectations for the season and that the shut down of work for winter will not find the actual accomplishment very far short of the program outlined at the beginning of the season.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS TO RESTRICT ADMISSION TO MEMBERSHIP AFTER JUNE, 1923

On the occasion of the 50th anniversary of its foundation the Institution of Municipal and County Engineers will have a motion on the Agenda for its Annual General Meeting in June or July, 1923, which will have the effect of restricting admission to corporate membership to engineers who possess a professional diploma or certificate, or University Degree, awarded after examination by some responsible body. This has been commonly required from applicants for Associate Membership for a considerable time, but it appears to be the general opinion of the profession that the facilities for obtaining certificates in engineering are now such that experience alone should not be held to entitle engineers to claim equality with those who have obtained certificates in addition to experience. The alteration was recommended for adoption in 1923 at the 49th Annual General Meeting.

LENGTH OF WORKING SEASON BIG FACTOR IN ROAD BUILDING

The length of the working season is a most important element in road construction and one in which there is considerable variation, according to the U. S. Bureau, which has collected data from all of the states.

Deducting Sundays only there are 313 working-days in the year and Alabama, Mississippi and New Mexico report that grading is possible on 300 of them. Neighboring states report as follows: Florida, 265; Louisiana, 260, and Texas, 275. Contrasted with these are Maine, with 110; New York, 150; Wisconsin, 153, and Western Oregon, 100. In 14 states grading will probably be impractical after the middle of November, and in some of them at an earlier date.

Gravel surfacing can be placed in most of the states on from 120 to 200 working days, although 10 of them report a greater number.

In 26 states concrete surfacing can be placed on from 100 to 150 days, and in 16 states on from 150 to 200 days. In 28 states the season is generally over by November 1.

LITTLE FALLS, MINN., CELEBRATES OPENING OF PAVED ROAD

Many Attend Event, Which Marks Completion of Notable Highway Project

Little Falls, Minn., on Thursday, November 9, celebrated the opening of the new paved state highway which ends five miles north of there. This was the first of two celebrations planned in honor of the longest continuous stretch of paved road in Minnesota.

The paved stretch of road from Fairibault to St. Paul is on Trunk Highway No. 1, from Minneapolis to St. Cloud on Trunk Highway No. 3, and from St. Cloud to Little Falls on Trunk Highway No. 27, a total of 175 miles. All of the paving was paid for by bonds issued by the counties through which the road runs, these bonds being issued under the state refundment law which provides that all such bonds when issued for work done on trunk highways shall be assumed, both principal and interest, by the highway department and paid out of highway funds.

The last stretch of pavement, 36.7 miles in length, was constructed about two weeks ahead of the date set in the contract and in doing the work the company established a world's record for rapid work. In one working day of 10 hours the company's crews laid 1,342 feet of concrete, 18 feet wide and seven and a half inches thick. This, they claim, beats all records for paving anywhere in the United States.

Large delegations were present at the celebration from the Twin Cities, St. Cloud, Fairibault, Long Prairie, Brainerd, and many other points throughout the state. The St. Paul association sent a large representation and St. Cloud sent many cars with its crack city band. Long Prairie brought a band and Brainerd was accompanied by the American Legion quartette. Hundreds of farmers from Morrison county were present with their families. Perhaps the most interesting feature of the parade, however, was the appearance of hundreds of school children in groups costumed to represent the various periods of the city's history. There were Indians, fur traders and hunters, soldiers and early settlers.

Highway Commissioner C. M. Babcock told his hearers that they were the real stockholders of the highway organization, the ones who furnish the money with which the department did its work and that he was there to make a report on the work. He said that he wished to answer a statement that had been made that only a small part of the money received by the department from the automobile tax went into the actual building of roads. Under the law 40 per cent of the money received must be spent on maintenance work. He described how this money was spent and said that less than 5 cents of each dollar spent in maintenance work was for supervision and overhead. In construction work, he said the overhead expense was less than 2 cents of the dollar. In both cases the overhead expense was much less than in any other state.

UNITED STATES GOOD ROADS ASSOCIATION TO HOLD CONVENTION IN APRIL

Much activity is going forward at the headquarters in Birmingham in arranging details of the 11th annual convention of the United States Good Roads Association, and the 6th annual convention of the Bankhead National Highway Association, conference on highway engineers, automobile dealers and owners, that will be held in Greenville, South Carolina, during the week of April 16-21, 1923. In conjunction with these different organizations, the United States Good Roads Show of road material, road machinery, trucks, automobiles and tractors, will be held in Textile Hall during the week. Director General J. A. Rountree of these organizations, announces that ten Governors, five United States Senators, one Cabinet officer, three members of Congress, and more than a dozen distinguished good roads advocates have accepted invitations to attend these conventions, deliver addresses and take active part in the same. With the number of distinguished guests that have accepted invitations, the publicity that is being given, it is predicted that the largest crowd of good roads enthusiasts that has ever assembled in the United States will journey to Greenville, next April. It will be a splendid opportunity for the people of the country to see the wonderful roads of the South, the cotton mills, as well as "The Textile Center of the South," as well as to see the great display of road machinery, automobiles and trucks that will be exhibited at the United States Good Roads Show.

SELECTING THE FEDERAL AID SYSTEM

The selection of the roads which will compose the system of Federal-aid highways which will reach into practically every county of the nation is progressing rapidly according to the U. S. Bureau of Public Roads. State and federal engineers have held numerous conferences during the past summer in all sections of the country. The system is being outlined in accordance with the requirements of the Federal Highway Act of last November which contemplates a system of highways to be built with Federal-aid such as no other nation has ever possessed and which, once built, will be continuously maintained in serviceable condition. Eighteen feet will be the minimum width of roadway unless conditions justify a lesser width and such cases must be given special approval. The system will consist of not more than 7 per cent of the total road mileage in any one state, not more than 3/7 of which will be primary or interstate highways and the remainder secondary or intercounty highways. The total mileage of primary and secondary roads will be approximately 187,000 miles.

Work has progressed rapidly on the system during the past year and 10,000 miles of road have been completed in conjunction with Federal-aid. These have been projects of such importance that there is no doubt as to their being included in the system as finally outlined.

The following table gives the approximate mileage of the primary and secondary system in the various states. In 13 states the figures are based on the total mileage of highways in the state, while the remainder are based on maps submitted.

	Mileage in Primary System	Mileage in Secondary System	Total Federal-aid System
Alabama	1696	2262	3958
Arizona	642	856	1498
Arkansas	2158	2879	5037
California	2015	2432	4447
Colorado	1440	1920	3360
Connecticut	350	470	820
Delaware	115	151	266
Florida	1127	833	2960
Georgia	2427	3235	5662
Idaho	1163	1609	2772
Illinois	2888	3851	6739
Indiana	2128	2838	4966
Iowa	2930	4214	7144
Kansas	3216	3384	6600
Kentucky	1370	1880	3250
Louisiana	1200	1600	2800
Maine	492	834	1326
Maryland	444	592	1036
Massachusetts	553	737	1290
Michigan	2250	3000	5250
Minnesota	3091	4122	7213
Mississippi	1416	1874	3290
Missouri	2345	4461	7806
Montana	2000	2700	4700
Nebraska	2408	3211	5619
Nevada	600	920	1520
New Hampshire	293	707	1000
New Jersey	513	685	1198
New Mexico	1390	1867	3257
New York	2150	2404	4554
North Carolina	1840	2354	4194
North Dakota	2061	2754	4815
Ohio	1690	2315	4005
Oklahoma	3381	4508	7889
Oregon	1177	1628	2805
Pennsylvania	2700	3600	6300
Rhode Island	79	86	165
South Carolina	1371	1854	3225
South Dakota	3462	4615	8077
Tennessee	1329	2748	4077
Texas	3640	8015	10655
Utah	690	965	1655
Vermont	444	599	1043
Virginia	1600	2133	3733
Washington	1273	1697	2970
West Virginia	942	768	1710
Wisconsin	2364	3152	5516
Wyoming	1288	1946	3234
Totals	71,492	98,079	187,406

From the present outlook it is thought that this program of road construction will cover a period of from 15 to 20 years. Many states will complete their mileage in a much shorter time, as they have included in the system a considerable mileage of improved road. They will then enlarge the Federal-aid system by including additional mileage. When the system is complete the total improved road mileage of the country will be far greater than the 187,000 miles included in the system. How much greater it is hard to say, but in all of the states the system has been outlined, keeping in mind that state roads independent of Federal-aid will connect with it.

MINNESOTA STATE HIGHWAY DEPARTMENT WILL RECOMMEND NEW BOND ISSUES TO 1923 LEGISLATURE

Bonds to help Minnesota to go on with its highway program, keeping pace with other good roads states, automobile tax revisions and other changes in existing laws are to be recommended to the Legislature of 1923 by the state highway department, Commissioner Charles M. Babcock announces.

First, the department proposes that the reimbursement bond law be put in effect again for the benefit of counties which did not act under its provisions. The law was originated in the 1919 Legislature to prevent possible neglect of proposed trunk highways in anticipation of the passage of Good Roads Amendment No. 1. It authorized counties under certain conditions to sell up the $250,000 each of bonds for use on their respective portions of proposed trunk routes, implying that interest and principal would be paid from the trunk highway fund when created. Many counties sold bonds in different amounts under this law, it is explained, and gained leads over others. The highway department proposes to even up the program by giving all counties like opportunties, although the new bonds to be sold will depend upon votes of county commissioners as before.

Many other states now joining in the better roads movement with liberal funds available, highway officials assert, and Minnesota must speed up its program to retain its present reputation as a leader and profit by the most direct returns. To that end, the first issues of state trunk highway bonds of $10,000,000 for 1923 and 1924, as provided under Amendment No. 1, are to be recommended to the legislature. Besides extensive grading and graveling improvements, this will insure some paving on heavy traffic sections where the cost of maintaining even unsatisfactory gravel surfacing is more than would be the cost of paving, bond interest included.

Changes of motor vehicle taxes, without reduction of the aggregate revenue from this source, will be supported by the highway department. It will be maintained that the average automobile and truck owners already save on car expense, gasoline and tires through road betterments in amounts equaling or exceeding their taxes. While the scheme under which old cars are taxed higher than new of the same makes and models, the officials said, big declines in car prices must be considered in fixing new rates. Any other action would seriously cripple the plan that is giving Minnesota better roads in record time and at cost below average.

Highway officials declare themselves in favor of the gasoline tax under which light cars pay more than heavy machines and each car in proportion to the mileage it covers, but insist that it should be only a part of the tax. They contend that taxable property value considerations cannot be ignored in any fair and just plan. However, each cent a gallon on gasoline in Minnesota would take about $4 a year from the average car owner and yield $1,125,000 annually for extra or additional improvements on the roads, also it would permit tourists from other states to contribute to the cost of roads they use here. The greater good roads savings, they claim, would make it a highly profitable investment and the road program would be materially advanced from year to year.

Commissioner Babcock, commenting on the cry for lower taxes, said road levies in many ways are in a special class. Official records show the first reduction of nearly $1,300,000 in county, township and city-village taxes for roads and bridges came the first year after the new highway plan took effect; also that larger cuts are indicated in future years. Local roads will be improved more rapidly in spite of the reductions, the commissioner said, because the state now is building and maintaining highways which formerly took a big part of local funds. State work is being paid for entirely from federal aid and motor vehicle tax receipts. The autotaxes represent money which otherwise would leave the state and go to automobile and tire manufacturers and oil refiners.

Brief reference was made by Commissioner Babcock to the implied understanding under Amendment No. 1 that $10,000,000 a year would be provided for the trunk highway system which serves four-fifths of the highway traffic in the state. Instead, current revenues have been $2,500,000 less than that sum and approximately a quarter of Minnesota road funds —$20,000,000 being the recent average for local road purposes.

The average vehicle tax last year was $16.73, against the $18 average pledged and $20 predicted by experts assisting in the framing of the law. This alone curtailed the trunk highway fund more than $400,000 last year.

Reduction in federal aid appropriations to half the amounts voted in previous years cost Minnesota more than $1,400,000 of trunk highway revenue in each of the last two years.

Extensive foundation work-grading, tiling and other betterments which are overlooked by the average highway user who judges a road by its surface and riding quality took a large percentage of construction money during the 18 months of actual operations under the new plan. Surfacing of these sections, however, will add greatly to showings in the near future.

Reasonable provisions made to continue the highway program, Commissioner Babcock said, Minnesota will live up to the reputation it now enjoys and be able the sooner to advertise a complete system of adequate highways.

OFFICIAL PROPOSALS

HIGHWAY WORK

Notice to Contractors

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M., on Tuesday, December 19. 1922, for the improvement of highways in the following counties:

ALBANY	(one highway: 0.23)
CATTARAUGUS	(one highway: 0.15)
MONROE	(one highway: 0.12)
ONTARIO	(one highway: 0.41)
OTESEGO	(one highway: 0.48)
STEUBEN	(one highway: 4.24)
SUFFOLK	(two highways: Gravity Concrete Retaining wall)

Also for the reconstruction of the following:

MONTGOMERY	(two contracts: 1.50 & 2.50)
NIAGARA	(one contract: 5.13)
STEUBEN	(one contract: 3.00)
SUFFOLK	(one contract: 4.50)
TIOGA	(one contract: 3.18)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose divison the roads are to be improved or reconstructed. The addresses of the Division Engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
Secretary.

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TABLE OF CONTENTS

The Economic Value of Highway Transport Franchises 193
By Arthur H. Blanchard

A Patrol System of Road Repairs 194
By Rollen J. Windrow

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT:

Eastern Washington Highway Association Plans Ambitious Program of Roadbuilding for 1924 and 1925 196

Oklahoma Society of Engineers Indorse Good Roads Program 196

Minnesota Lets Gravel Jobs; Asks for Bids on Bridge 196

Standard Contract Being Revised 197

Students Build Roads 197

Illinois Road Contractors to Hold Annual Convention, January 15-16 197

Ship Livestock With Truck Is Latest Method . . . 197

United States Civil Service Examination for Highway Engineer 197

Shade Trees to Line Michigan Highways 197

Minnesota Proposes Adequate Funds for Highways . 197

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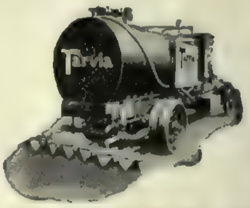

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIII DECEMBER 6, 1922 No. 23

The Economic Value of Highway Transport Franchises

By ARTHUR H. BLANCHARD

President, National Highway Traffic Association.

WHAT is a highway transport franchise? Although the phrase "highway transport franchise" has not been officially defined, it may be explained, as used in this paper, in order that the discussion of this topic may be intelligently comprehended. A state highway transport franchise constitutes an agreement between a state controlling body, as the party of the first part, and the highway transport operator, as the party of the second part, covering a guarantee of definite service on a prescribed route under stipulated conditions by the highway transport operator and a guarantee by the state that there shall not be unwarranted, ruinous competition by other highway transport operators.

What the Franchise Covers

Highway transport operators under franchises are motor vehicle common carriers, as they carry indiscriminately, within reasonable limitations, all persons or commodities, under general conditions of agreement applicable to the whole puglic on defined routes according to definite service schedules.

For example, it is evident that the highway transport services rendered in accordance with the following definitions may be covered and controlled by highway transport franchises:

1. Rural Motor Express pertains to the highway transportation of commodities on defined routes according to service schedules from several producers in a rural district to a terminal with or without return loads being carried from the terminal to the producers or other consumers.
2. Intercity Motor Express pertains to the transportation of commodities on defined routes between municipalities according to service schedules with or without service being rendered at intermediate points.

On the other hand, it is believed that the following defined services cannot efficiently or legally be covered by franchises:

1. Long and Short Rural Haulage includes all highway transport methods which utilize highways outside of municipalities except intercity haulage and highway transport operating on defined routes according to service schedules.
2. Intercity Haulage pertains to highway transportation of commodities on defined routes becept highway transport operating on defined routes according to service schedules.

The same conclusions apply to the commercial transportation of persons.

The legal right of the state to control the operations of common carriers is generally admitted except in the case of interstate common carriers. At the present time, at least twenty-two states provide in their statutes for some degree of state control over motor vehicle common carriers.

Are highway transport franchises an economic and public necessity? To those familiar with the development of the commercial transportation of commodities and passengers by motor vehicles during the past fifteen years in the United States and the longer history of highway transport in Great Britain, the answer is unreservedly in the affirmative.

Reasons for Failures

Failures of highway transport enterprises are occurring every day due to a lack of knowledge of the fundamentals of the economics, science and art of highway transport. It is reported that 90 per cent of all highway transport companies doing business with New York City as a center fail within three years after entering this field. While 50 per cent may fail due to cut-throat competition by fly-by-night companies, it is conservatively estimated that at least 50 per cent fail because of lack of knowledge of the A B C's of efficient highway transport business methods, cost accounting, management, and the operation and maintenance of equipment. Those interested in the efficient development of highway transport in the United States have a big task before them in bringing to the attention of groups of business men or capitalists, operators and prospective operators of highway transport, the necessity of having connected with their operating organizations men who are thoroughly trained in the methods of highway transport, the interrelationship of highway, railway and waterway transport, highway transport legislation, the fundamentals of highway transport cost and record systems and the principles of highway transport management, together, of course, with a knowledge of the mechanism, operation and maintenance of motor trucks, tractors and trailers.

As an integral part of the essential transportation

Abstract of a paper presented at a joint meeting of the North Central Division of the National Highway Traffic Association and the Michigan State Good Roads Association held at Grand Rapids, Michigan, on November 21, 1922.

system of America, it is absolutely necessary that highway transport be placed upon a sound business basis in order that responsible operators may be protected and that this branch of common carrier service may be conducted in such a manner as will guarantee to the public constant, efficient, economic service.

From the standpoint of public safety, the state must insist that our motor vehicle common carriers transporting passengers provide a maximum degree of safety to the traveling public and eliminate reckless driving by inexperienced chauffeurs and the utilization of wholly inadequate motor vehicle equipment which may be characterized in some cases as a piece of junk carrying a packing box in which persons are jammed, the resulting contrivance being called a motor bus.

Based on an analysis of all state statutes covering the control of motor vehicle operation, the powers given to state public service controlling bodies may be classified as follows:*

1. Grant, refuse to grant, amend or revoke Certificates of Public Convenience and Necessity.
2. Prescribe routes.
3. Fix schedules.
4. Determine character of service and promote the comfort and safety of traveling public.
5. Establish fares and rates.
6. Require reports and uniform methods of accounting.
7. Examine accounts and records.
8. Supervise fiscal affairs such as incorporation, capitalization of stock, etc.
9. Compel additions to, extensions of or betterments in physical equipment.

If the powers enumerated are given to a state controlling body, what should be the qualifications of the members of such a body? It is evident that a grave responsibility to the public and to highway transport business will rest upon them. They should be men possessing vision, judicial mind's and a broad knowledge of transportation, and should be unprejudiced pertaining to the relative development of railway, waterway and highway transport. Different fields of public and business affairs should be represented. An efficient controlling body might be made up of the Attorney General of the state as an ex-officio member; a highway transport man of high standing and possessing a broad knowledge of the development of all phases of transportation of commodities and passengers by motor vehicles; an experienced highway engineer, who understands the fundamentals of highway transport and who thoroughly comprehends the relationship existing between the economic operation of highway transport and such highway factors as grades, alignments, widths, drainage, foundations, the charcter and maintenance of road way surfaces, and the methods of controlling and directing the operation of traffic on highways; a business man who has dealt with big commercial problems; and a banker who is familiar with the practice of bonding common carriers and other enterprises in connection with the operation of which the public must be protected. To this group of five might be added a steam railroad man and an electric railway man provided that they possess a broad vision relative to the development of transportation in America, such as is possessed by W. H. Lyford, Vice-President of the Chicago and Southern Illinois Railway. Mr. Lyford's comprehensive knowledge of the transportation problems of the United States was shown to the public through the medium of his admirable address* before the Second National Conference on Highway Engineering and Highway Transport Education in Washington in October, 1922, during which he vividly outlined the many fields of railway transportation in connection with which highway transport may be efficiently employed and how the improvement of highways and the development of highway transport is of direct benefit to the railroads. At least 90 per cent of the railway officials of the United States could profitably digest Mr. Lyford's conclusions with the result that many would be converted and in the future would not exhibit that narrow-mindedness which has led many to vigorously protest against the use of railroad taxes for highway improvement, and the development of highway transport.

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*Report by Motor Vehicle Conference Committee, March 1, 1922.

*See "Good Roads" for November 22 and 29, 1922.

A Patrol System of Road Repairs

By ROLLEN J. WINDROW

Former Texas State Highway Engineer.

THE process of revolutionizing our methods of transportation by the development of the motor vehicle has been so rapid that we who have been charged with the official duty of meeting the demands of such traffic have scarcely had time to do more than turn from one temporary remedy to another in our desperate efforts to handle the situation.

We have, from time to time, hurriedly attempted to draft legislation that would be within the limits of a constitution written before the motor vehicle was dreamed of and that would still provide funds for the construction of adequate roads. More recently we have begun to attempt some legislation aimed to provide for the maintenance of these roads. We find the latter much the more difficult problem, owing to the very restricted and definite limits set out in our constitution, regarding the raising of funds for road maintenance.

I do not take the extreme view that the larger per cent of the bond money that has been voted in the various counties of this state has gone for naught, for even though full value has not been received in road construction for the money expended, the lessons that we have learned by the mistake that have been made offset to a large extent the great sums that have been dissipated. We must soon stop the foolish policy of burning the candle at both ends, which consists in voting long-term bonds for building short-term roads. Raising maintenance funds does not permit the raising of sufficient funds for properly maintaining even the higher types of construction which, of course, cost less to maintain than the cheaper types of surfacing. In this state we have devised ways of raising construction funds that make it comparatively easy to finance such work, especially so in the counties of larger

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Abstract of an address before the Texas Commercial Conference and Annual Meeting of Texas Chamber of Commerce.

valuations, but no way has been devised under our present constitution whereby a fund can be guaranteed that is anywhere near adequate for maintaining even the higher types of road surfaces under present traffic conditions.

Do you know that there are some counties in this state which have already voted their constitutional limit of bonds and have spent the proceeds of these bonds in constructing sand-clay and gravel roads that will probably be worn out entirely within four or five years? Some of these counties have even gone to the extreme of issuing anticipation warrants against their road maintenance fund, thereby hastening the time of the complete destruction of the roads that they have constructed, as they will have no sort of fund for maintenance purposes. There is not a county in Texas that has sufficient funds, even though it has levied the regular 15-cent road and bridge tax, and is using its automobile funds strictly for maintenance, that has sufficient funds to maintain adequately its system of roads. Some of the more wealthy counties would probably have enough money for this purpose if their roads and bridges were all constructed of durable type and the very best plan of organizing and supervising this work were adopted.

The Situation Summarized

We might sum up the present situation as it exists in Texas today, briefly, as follows:

1. The existing laws permitting the voting of county and road district bonds for road construction are very liberal.

2. The county commissioners' court may levy not to exceed a 15-cent tax on a $100 valuation for general road and bridge purposes. By a special vote of the people, an additional 15-cent tax may be assessed for road maintenance. In addition 50 per cent of the motor vehicle license fees are retained by each county for road maintenance purposes.

3. The constitution does not provide for the issuance of bonds or the levying of a state tax for creating a state fund for road construction. The only state fund available for this purpose at the present time is that derived from 50 per cent of the motor vehicle license fees.

4. There is no state fund provided at this time for maintenance of roads, not even projects which it has aided in constructing.

5. The Federal Government has made two appropriations to date for aiding in the construction of state system of roads.

6. The State Highway Department is now spending this fund, together with the state fund as it accrues in aiding the various counties of the state that have provided their per cent of the cost in constructing portions of a system of state highways which have been designated by the State Highway Commission.

7. The State Highway Commission has designated a system of roads comprising about 16,000 miles. They have divided this system into two classes. Class A includes about 8000 miles of road that are more or less interstate in character. Class B, which includes the remainder of the designated system, is more or less strictly state roads.

8. The State Highway Department has found under the present manner of handling construction work on this system of highways, that it is compelled, due to the limited funds that the county authorities are willing or able to set aside for highway construction, to participate in a great many instances in the construction of types of road surfaces that it recognizes as inadequate to the demands of the traffic.

9. The State Highway Department cannot initiate a road project on any part of our highway system, but must wait until the county has provided funds and the county officials feel disposed to submit a proposition. This has resulted in portions of very important highways being built through certain counties of varying types of construction; while other portions on the same highway are not being constructed and will probably not be for a great many years—perhaps never as long as we must depend on the counties to initiate the proposition.

10. As soon as a project is furnished it is turned entirely over to the county commissioners' court to maintain as it sees fit, or as the funds at its disposal will permit. Usually whatever maintenance work is done is under the direction of an experienced man using some "hit or miss" method.

11. Members of the commissioners' court are elected by each precinct of the county instead of the county at large. Therefore, each commissioner's interest is in getting as much as possible out of the road construction or maintenance funds for the roads in his own precinct, regardless of their relative importance to the county or state as a whole.

12. During the last Special Session of the Legislature a bill was passed known as the Davidson-Perkins bill, which, however, is only applicable to thirty-six counties, that is intended to inaugurate a patrol system of highway maintenance. While this was, no doubt, a step in the right direction, it necessarily falls short of meeting the demands of the situation, principally due to the constitutional limitation that had to be met by its authors.

A careful study of the existing conditions as outlined above will lead one to the conclusion that we must make some very radical changes in our constitution and laws to correct the very fundamentals of our system before any effective methods of highway maintenance can be evolved.

Suggestions for Reform

Bearing all of the foregoing in mind, what can we suggest for placing this whole proposition on a better business basis?

First: Recognizing the fact that with the present motorized vehicle that certain roads have become more important arteries in our interstate and transcontinental systems of highway transportation than others, it is nothing but right that these highways should be included in the major state highway systems and co-ordinated into a Federal system of roads. The construction and maintenance of these roads should be financed almost entirely by the Federal and state governments co-operating. The design, construction, and maintenance of these highways should be under the direct supervision of the various state highway departments and should be practically free from the control of the local county authorities.

Second: A secondary system of state highways, which to a certain extent only are interstate in character, should be constructed with funds provided by the Federal, state and county governments, Federal and state aid of course being given to a lesser extent than in the major systems. The maintenance of these highways should be financed by and directly under the supervision of the state.

Third: The county highway system which should comprise roads of more or less local importance should be constructed and maintained at the expense of the county.

Fourth: For providing state funds for road construction work the constitution should be changed so as to permit the issuing of bonds or the levying of a direct state tax. It would not be improper to assess a sufficient license fee against the motor vehicle owners to provide a state fund that could be used for maintenance purposes on the major and secondary systems. If necessary this fund could be supplemented by the levying of a gasoline tax

(Concluded on page 198)

Current Events in the Field of Highway Engineering and Transport

Eastern Washington Highway Association Plans Ambitious Program of Roadbuilding for 1924 and 1925

$2,900,000 To Be Spent Under Plan Adopted

More than 360 good roads workers and legislative members from East Side counties attended the biennial conference of the Eastern Washington Highway Association at Spokane, November 18, when eastern Washington's road-building program for 1924 and 1925 was outlined for submission to the legislature. Harmony and enthusiasm ruled the meeting.

Continuance of the present policy of highway construction and maintenance as well as the present system of taxation for highway purposes, was indorsed by the conference. The association passed a resolution to emphasize that, despite disturbed financial and economical conditions, "it would be false economy to make any radical changes at this time."

The proposed program of Frank W. Guilbert, president of the association, under which eastern Washington would spend $2,900,000 in each of the next two years, was adopted unanimously. Following adoption of the report and resolutions, Mr. Guilbert was unanimously reelected as president for the ninth term.

The following program for submission to the legislature, which was presented by President Guilbert, was adopted:

Eastern division, Inland Empire highway, Palouse to Pullman, $250,000; North Central highway, Odessa to Marlin, $100,000; Inland Empire highway, north from Colville, $60,000. Paving. Inland Empire highway, Spokane south city limits through Rosalia, $800,000; 32 per cent; Inland Empire highway, Waitsburg through Dayton, $350,000; 14 per cent. Inland Empire highway, between Pasco and Walla Walla, $210,000; 8 per cent. Inland Empire highway, extension of Colfax paving north to Steptoe, $200,000; 8 per cent. Sunset highway, east Lincoln county line through Reardan. $200,000; 8 per cent. Sunset Highway, Wenatchee toward Orondo, $90,000; 3½ per cent. Central Washington highway, Sunset highway toward Cheney, $90,000; 3½ per cent.

Grading and Blasting—Okanogan county—on Chelan-Okanogan and Roosevelt highways, $75,000; 3 per cent. State road No. 4, from Wilbur northerly toward Republic, $100,000; 4 per cent. State road No. 4, Tonasket and Republic, $45,000; 2 per cent. State road No. 22, between Davenport and Meyers Falls, $100,000; 4 per cent. Pend Oreille highway, Newport north, $100,000; 4 per cent. North Central highway, Soap Lake easterly, $60,000; 2½ per cent. Balance for necessary gaps, additional paving or authorized surveys, $70,000; 3 per cent.

Two extensions to the state highway system were recommended as follows:

Pend Oreille highway be extended northerly along the west bank of the Pend Oreille river to Meraline, thence across the existing bridge easterly to the east side of the river at Metaline Falls, thence northerly to join the Canadian system of highways at a point on the Canadian boundary.

"A branch of the eastern division of the Inland Empire highway southerly from Clarkston, in Asotin county, to a point connecting with the Oregon system on the southern line of Asotin county, be added to the state road system.

"Provided, it is the sense of this meeting that no further additions in mileage be made to the state road system until the present system, with the above additions, has been completed."

Resolutions were adopted in favor of state regulations as to speed, weight and width of tires for trucks, compensation for state or municipality for highway damage by trucks; regulations for solid and pneumatic tires for trucks; removal of automobiles from the list of tax-exempt property; retention of 1 mill levy, plus revenue from motor license and the gasoline tax at 1 cent; retention of the 1½ mill permanent highway levy under present system; a percentage tax, upon earnings of highways and roads. This resolutions report included an appreciation of the administration of James Allen, state supervisor of highways.

Stevens county has the largest delegation present, 97 members. The Stevens county people, headed by Herman Josefesky and J. M. Glasgow, members of the legislature, came down with the slogan of "State road 22 or bust." No "busting" was required, however, as President Guilbert's report included a recommendation of $100,000 for improving the road between Davenport and Meyers Falls.

Whitman county was represented by 75 delegates, the second largest county unit The Pend Oreille delegation included Fred Wolf, Newport, president of the Washington Good Roads association; Fred Trumbull, Ione, and E. S. Appel, Metaline Falls, newly elected legislator. State Senator Charles Myers and J. L. Thayer headed the Lincoln county delegation.

W. W. Downie, Harrington, and F. L. Crowe, Spokane, were reelected as treasurer and secretary. Two new vice-presidents were chosen in Louis G. Keller, Colville, and Dr. J. Floyd Tifft, Colfax. The board of trustees, one for each county, was elected as follows: Dr. S. B. L. Penrose, Walla Walla; William Duling, Whitman; William Davis, Pend Oreille; J. L. Thayer, Lincoln; John G. Kulser, Stevens; R. B. McFarland, Franklin; F. H. Haupt, Adams; E. W. Fawley, Douglas; C. A. Gray, Ferry; Ben E. Thomas, Grant; H. J. Doolittle, Spokane; John R. Stevenson, Garfield; J. L. Dumas, Columbia; Ross Brattain, Okanogan.

OKLAHOMA SOCIETY OF ENGINEERS INDORSE GOOD ROADS PROGRAM

The Oklahoma Society of Engineers at its annual meeting, December 2, at Oklahoma City, voted unanimously to amalgamate with the American Association of Engineers and to form the Oklahoma Division of the Association. Dan W. Patton of Tulsa was elected president; Max L. Cunningham of Oklahoma City, vice-president, and E. K. Ramsey of Oklahoma City, secretary-treasurer.

The new officers have outlined a program of state activity, including license law for engineers, amendments to the paving law, and a good roads program, all of which meet with the favor of Governor-elect J. C. Walton, a member of the Association. With a united engineering sentiment in Oklahoma the Oklahoma Division, composed of chapters at Muskogee, Tulsa, Oklahoma City, and the Oklahoma Society of Engineers, expects to accomplish much in the next year in the way of engineering and public interest.

The meeting was held at the Skirvin Hotel and among the speakers were Senator Ross Lillard and Representatives-elect Allen Street and R. A. Singletary. G. A. Paul spoke on "Amendments to the Paving Law" and Max L. Cunningham on "Engineers License Law."

MINNESOTA LETS GRAVEL JOBS; ASKS FOR BIDS ON BRIDGE

Commissioner Babcock Pushes Highway Work While Prices Are At Low Levels

Contract awards for 150 miles of new graveling and other winter work at low prices and a call for bids December 28 on nine new bridges for Minnesota trunk highways toward taking further advantage of favorable conditions and speeding needed road improvements, were recently announced by Charles M. Babcock, state highway commission.

Winter work was let at low figures as a year ago, bids being nearly 20 per cent under engineers' estimates, according to John H. Mullen, assistant commissioner and chief highway engineer. Highway officials agreed that the low figures furnish a strong argument for issuing trunk bonds now to get needed improvements at bargain rates. Many bids from local contractors in many parts of the state helped to make the savings, and there was record-breaking competition, 60 bids being received on one undertaking alone.

The first exclusive call for bids on important bridge improvement under the Babcock plan was made public by J. T. Ellison, assistant highway commissioner and chief bridge engineer. The six concrete and three steel bridges are estimated to cost nearly $175,000, he said, and all are badly needed on the trunk system. Some steel structures are planned, he explained, to keep costs down and to avoid unnecessary obstruction of streams. The list of new bridges proposed for early construction:

T. H. No. 1.—Over Straight River in Owatonna, 120-foot concrete bridge of 3 spans, 24-foot roadway and one 8-foot sidewalk. T

T. H. No. 5.—Over Minnesota River at LeSueur, 400-foot steel bridge with creosoted wood block floor, to be pushed to completion.

T. H. No. 5.—Over Swan River at Mississippi Junction, 75-foot steel and timber bridge with 20-foot roadway.

T. H. No. 8.—Over Mississippi River between Bemidji and Gass Lake, 225-foot bridge of 3 spans, 20-foot roadway.

T. H. No. 10.—East of Maple Plain, 10x6-foot culvert on timber piling.

T. H. No. 11.—Over Baudette River between Baudette and Spooner, 400-foot steel bridge of 5 deck truss spans, 20-foot roadway, 5-foot walk.

T. H. No. 11.—Near Ericksburg, 15-foot pile trestle, 20-foot roadway.

T. H. No. 16.—Over Des Moines River and boat channel, in Windom, 120-foot concrete bridge of 3 deck girder spans, and 50-foot concrete deck girder, each with 24-foot roadway and two 5-foot sidewalks.

T. H. No. 17.—South of Marshall, double 20-foot concrete slab span with 20-foot roadway. T

All foregoing improvements are being made under the highway department policy to distribute betterments widely to benefit all sections and to use money as fast as it becomes available for public service through good roads.

STANDARD CONTRACT BEING REVISED

Second Tentative Draft Drawn Up At Meeting Held In Washington November 27.

The Universal Contract Agreement previously formulated by the Joint Conference on Construction Contracts was revised at the last meeting of the Joint Conference, held in Washington, November 27. It is now being sent to the various associations constituting the conference for their approval. The first tentative draft was drawn up at the April meeting of the Conference and submitted to the member associations, who submitted their criticisms and suggestions concerning changes that should be made in the form.

At the last meeting these criticisms and suggestions were consolidated and incorporated into the second draft. To those associations who have already reported and made their suggestions, the second tentative draft is being submitted for approval, while to those who have not so reported the revised draft is being submitted for further criticism and report.

Those associations which submitted definite reports were the American Institute of Architects, the Federated Ameri- pears that no obstacle lies in the way of their adoption of the second draft. It is ations were of such a nature that it ap- can Engineering Societies, Western Society of Engineers, and the A. G. C. The suggestions made by these four associ- believed that definite approval can be obtained in the near future from five of the nine associations represented on the conference.

UNIVERSITY OF MISSOURI STUDENTS BUILD ROADS

Three hundred University of Missouri engineering students recently volunteered their services for repairing the Columbia-Rocheport section of the Old Trails roads, between St. Louis and Kansas City.

The road, which was hard-surfaced a number of years ago, is described by tourists as the worst in the United States.

The Missouri Automobile club, according to reports received here, has been sending tourists across the state by other routes because of this bad stretch of road.

ILLINOIS ROAD CONTRACTORS TO HOLD ANNUAL CONVENTION JANUARY 15-16

The Annual Meeting of the Illinois Association of Highway and Municipal Contractors will be held in Chicago, January 15-16, 1923, in connection with the Good Roads Show. Illustrated addresses and discussions of vital highway problems common to road builders and equipment manufacturers will be held during the two-day session.

CALENDAR OF COMING MEETINGS

Federated American Engineering Societies, Washington, D. C.; annual meeting Washington, Jan. 11-22, 1923.

American Roadbuilders Association, New York City; Annual Convention, Chicago, Jan. 15-18, 1923.

American Society of Civil Engineers, New York City; Annual meeting, New York City, Jan. 17 and 18, 1923.

American Concrete Institute, Detroit; annual convention, Cincinnati, Jan. 22-26, 1923.

Associated General Contractors of America, Washington, D. C.; annual meeting, Los Angeles, Jan. 30-Feb. 3, 1923.

SHIP LIVESTOCK WITH TRUCK IS LATEST METHOD

Marketing of live stock by truck is the latest development in the live stock industry. Although all of the principal centers in the United States have experienced an enormous growth of this form of marketing, the Sioux City market has undergone the greatest growth of all. At present more live stock is being brought to the Sioux City market by truck than to any other market in the United States. So rapid has been the development of this form of transporting live stock that practically all of the leading centers are providing adequate facilities for unloading cattle, sheep and hogs from the trucks with the greatest possible speed and convenience.

The general radius for trucks is 50 miles, but frequently loads come 100 miles and more. The greatest distance that a truck has brought live stock to the Sioux City market was from Armour, S. D., a 250-mile drive.

During the first eight months of this year more hogs were delivered by truck to the Sioux City market than to any other market in the United States.

MINNESOTA PROPOSES ADEQUATE FUNDS FOR HIGHWAYS

Bonds to help Minnesota to go on with its highway program, keeping pace with other good good roads states, automobile tax revisions and other changes in existing laws are to be recommended to the Legislature of 1923 by the state highway department, Charles M. Babcock, commissioner, has announced. First, the department proposes that the reimbursement bond law be put in effect again for the benefit of counties which did not act under its provisions. The law was originated in the 1919 Legislature to prevent possible neglect of proposed trunk highways in anticipation of the passage of Good Roads Amendment No. 1. It authorized counties under certain conditions to sell up the $250,000 each of bonds for use on their respective portions of proposed trunk routes, implying that interest and principal would be paid from the trunk highway fund when created. Many counties sold bonds in different amounts under this law, it is explained, and gained leads over others. The highway department proposes to even up the program by giving all counties like opportunities, although the new bonds to be sold will depend upon votes of county commissioners as before.

Many other states now joining in the better roads movement with liberal funds available, highway officials assert, Minnesota must speed up its program to retain its present reputation as a leader and profit by the most direct returns. To that end, the first issues of state trunk highway bonds of $10,000,000 for 1923 and 1924, as provided under Amendment No. 1, are to be recommended to the Legislature. Besides extensive grading and graveling improvements, this will insure some paving on heavy traffic sections where the cost of maintaining even unsatisfactory gravel surfacing is more than would be the cost of paving, bond interest included.

Changes of motor vehicle taxes, without reduction of the aggregate revenue from this source, will be supported by the highway department. It will be maintained that the average automobile and truck owners already save on car expense, gasoline and tires through road betterments in amounts equalling or exceeding their taxes. While the scheme under which old cars are taxed higher than new of the same makes and models, the officials said, big declines in car prices must be considered in fixing new rates. Any other action would seriously cripple the plan that is giving Minnesota better roads in record time and at cost below average.

OFFICIAL PROPOSALS

HIGHWAY WORK

Notice to Contractors

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M., on Tuesday, December 19, 1922, for the improvement of highways in the following counties:

ALBANY	(one highway: 0.23)
CATTARAUGUS	(one highway: 0.15)
MONROE	(one highway: 0.12)
ONTARIO	(one highway: 0.41)
OTESEGO	(one highway: 0.48)
STEUBEN	(one highway: 4.24)
SUFFOLK	(two highways: Gravity Concrete Retaining wall)

Also for the reconstruction of the following:

MONTGOMERY	(two contracts: 1.50 & 2.50)
NIAGARA	(one contract: 5.13)
STEUBEN	(one contract: 3.00)
SUFFOLK	(one contract: 4.50)
TIOGA	(one contract: 3.18)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose divison the roads are to be mproved or reconstructed. The addresses of the Division Engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
Secretary.

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1 8½ D. D. Acme crusher, 12x16, elevator, screen, portable bin and 20 H. P. gasoline engine.
1 Haiss wagon loader, gasoline driven.
1 Erie, type "B" combination crane and shovel.
2 75 H. P. locomotive type boilers, on skids.
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1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.
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50 Batch box cars and 30 cu. ft. batch boxes.
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4 6 ton, 24 in. ga Cummings locomotives.
2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
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1 7 ton guy derrick, 70 ft. boom.
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(Continued from page 195)

or a production tax on natural resources, such as oil, sulphur and other minerals.

Fifth: The constitution should also be amended so as to permit the counties to levy more than the present maximum of 30 cents on the $100 valuation for strictly maintenance purposes.

Sixth: Proper legislation should also be passed to safeguard money derived from long-term bonds so that it could be spent only for road improvements that are of a durable nature.

Seventh: County commissioners should be elected from the county at large so that their interest would not be localized to such a degree as at present. This bill required a constitutional amendment.

Eighth: The constitution should be amended so that the Davidson-Perkins Road Patrol Bill, or some such legislation could effectively provide for a patrol system or road maintenance, all work on county roads being placed under a competent road superintendent with the commissioners' court acting in a directory capacity only. The patrol system should also be provided for the state highway system, this work being under the direct supervision of the State Highway Department.

Shade trees of ornamental hard wood varieties planted every 100 ft. with nut trees midway between, are to line a seven-mile stretch of main trunk line road No. 2, west of Reed City, Michigan. Maple and elm saplings have been planted from their natural site in neighboring woods. This fall, nut bearing trees will be planted between the hard wood trees. County road officials and the Michigan State Highway Commission landscape engineer are co-operating in the planting.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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TABLE OF CONTENTS

Reducing the Cost of Road Construction 199

Regulating the Overlaoding of Motor Trucks . . 201
By David C. Fenner

Current Events in the Field of Highway Engineering and Transport . . . .

War Department Considering Road Developments for National Defense 203

Tolls on Roads and Bridges Would Reduce Construction Costs 203

Low Prices Continue on Minnesota Road Projects . 203

Traffic Marking Paint Tests Recently Completed . 203

Illinois Making Progress Map 203

Colorado Doubles Mileage of Roads in Seven Years . 203

Gasoline Savings Would Pave Road 204

Minnesota Good Roads Proposals To Be Made To Next Legislature 204

Good Roads Primer For Pennsylvania is Issued . . 205

Lee Highway Association To Hold Annual Convention in January 205

Personal Mention 205

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3. Elimination of one shipment of the plant, which is moved direct from the old work to the new without going into the contractor's storage yard.
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5. Better transportation service during early months of the season, with possibly preferential freight rates at that time.
6. Lower costs in the basic industries on account of a longer production season.

The total influence of fall letting affects so many factors in highway work that it is difficult to foretell what reduction of cost it would bring about, but contractors have estimated that the total cost of highway project could thereby be reduced 5 or 10 per cent. The importance of fall letting in relation to eliminating the waste from industry has made it the subject of correspondence between the Secretary of Commerce, Mr. Hoover, and the governors of all states.

Administering Contracts

The field experience of contractors has shown that most dissensions which arise between representatives of the high way departments and representatives of the contracting companies are due to an honest misunderstanding. Unless the cause of these misunderstandings is removed by exchange of views and discussion, they sometimes develop into cankerous enmity which interferes with proper execution of the work. Some means of providing such exchange is needed.

To encourage a mutual understanding of each other's problems in Iowa, a school for engineers, inspectors, superintendents and foremen was established prior to the beginning of the new work. It served to acquaint each party with the difficulties encountered by the other and thus laid the groundwork for more satisfactory relations between the department and its contractors. In the Iowa school the engineers and contractors evolve plans for executing the work, or if such plans have already been determined they see that all parties understand the plan and encourage suggestions for improvement. They also explain many of the questions which may be expected to arise from the details of any project and confer on other matters of mutual interest or benefit. This school, it was found, practically removed the element of personal friction and misunderstanding, and undoubtedly resulted in economy. Similar schools will probably result in more satisfactory contract performance if adopted in other states.

Another step towards removing many difficulties which arise in the field, and one which has already proved valuable, is the establishment of local conferences between engineers and contractors. These conferences would investigate local conditions which affect the work, determine economical methods for doing unusual work, or arrange to take advantage of unusual conditions in the locality with the object of economizing on the work. Such conferences conduct discussions that lead to better economies in road building and consequently to lower construction costs.

Contracts and specifications have frequently been regarded as delicate grounds in discussions between engineers and contractors, but it is nevertheless well understood that requirements commonly included in these documents cause unnecessary expense to the state. The state obviously needs certain protection and certain guarantees, but as the scope of these is increased it adds an element of uncertainty to the cost against which no construction company dare fail to provide insurance. This insurance, whether placed with an insurance company or carried as a contingent expense, increases the cost of roads. Insurance of this nature can often be carried more economically by the state, and if so carried it would make possible a reduction in the cost of surety bonds.

Limit Contractor's Risks

If the risks against which construction companies are required to furnish protection were limited to those things over which the companies can exercise some measure of control, and if they were not required to assume responsibility for damage from practically every cause, they could eliminate from their estimates a number of contingent expenses. Some of the contingencies occur so rarely that the cost of insuring against them can be more economically assumed directly by the state. The infrequent occurrence of a contingency, however, will not justify a construction company in failing to provide insurance. One occurrence of some of these contingencies is sufficient to bankrupt a construction company and the company must, therefore, protect itself financially. This the bonding company also does in establishing its rate. By eliminating from specifications those hazards and responsibilities which can be more economically assumed directly by the state, a lower rate on surety bonds can doubtless be obtained.

Bonding companies say that the rate could be further reduced if the state would exercise a more comprehensive interpretation of the term "responsible bidder." The ability to furnish bond is inadequate proof for bidders do obtain both state highway contracts and bonds, and their failures raise the bond rate. If the state were careful to secure bidders who are actually responsible the rate could not only be reduced but a reduction of bond could be made as sections of the work were completed and accepted. The savings thus made would reflect directly in the construction estimate. They would also reduce the total amount of money required to finance the work and hence the interest charges.

Reduction of Interest Charges

Interest charges can also be reduced by the following procedure:

1. Limit the percentage obtained by the state to an amount which experience has shown to be necessary.
2. Limit the money retained to that amount held when the work is 50 or 60 per cent complete.
3. Provide for a specific date and method of payment upon which the construction company may depend—thus eliminating the expense of emergency financing.
4. Return certified checks and make awards promptly so that bidders receiving no reward may look immediately for other work.

Interest charges in themselves are not a large per cent of the cost of building roads, but the procedure here suggested to reduce them will indirectly reduce other expenses. When all these items are combined the saving is significant. Any action which limits the uncertain costs and enables accurate estimating results in lower bids.

Classification of Excavation

Among the uncertain factors which prevent accurate estimating is the matter of classifying excavation. A lack of accurate classification in excavation always introduces an uncertainty which will not allow an estimator to get down to the bottom price. He cannot risk striking hard material with an earth price and if, for example, hard pan or a stiff gumbo is anticipated and but a single or two-grade classification is provided, the price must obviously cover the cost of such material. If, however, a classification is provided which segregates the various grades of material, a construction company can safely bid its lowest price on each.

Similar to the lack of classification is the practice of lumping different kinds of work under a single unit price. In all such cases a certain cost is introduced which does not permit the lowest unit prices. The remedy is obviously to separate into units those items which vary in cost and can be determined separately.

Still another uncertainty is caused by payment for overhaul. If a construction company is obliged to work under a predetermined overhaul price, it knows that under many conditions the price will not cover the expense, and this contingency must also be provided for, if the work is to be performed at a profit.

Likewise, the contract provision governing changes in the work usually creates a dangerous contingency. This provision allows one department to increase or decrease the work without making any adjustment in price for the resulting change in cost. Every quantity eliminated carries with it a certain portion of overhead which stands as a loss and, unless the construction company is assured the work will go practically as planned, it cannot estimate with any degree of accuracy. The consequence is another item of insurance.

A common practice in estimating, and one which finds favor with state highway departments, is to place all items of cost, or a proportionate part of them, where they properly belong. This cannot always be done if the so-designated "percentage of profit on force account" is based only on direct labor and materials. The usual percentage allowed is the same as that adopted years ago, yet any engineer knows that the proportion of direct labor has decreased while the indirect expense, such as equipment, has increased. The usual percentage does not always cover the cost. This the construction estimator knows and must take care of it in some other place. Such misplaced cost may in the end be more expensive for the state. A better plan is to account the work so that such expense can be definitely determined and settled. For this the contract can readily provide.

One other saving which the contract may bring about is that of inspecting materials at their source. Rejecting faulty aggregates after they have been unloaded precludes the construction company from recovering their cost. Inspection at the source would eliminate the waste of materials rejected on the work. This item of expense, like various others here cited, under "Contracts and Specifications," is of the indeterminate type and it is not possible to say definitely what economy it will bring about, but every construction company knows that if these suggested changes were instituted, it could and would submit lower bids.

Regulating the Overloading of Motor Truck

By DAVID C. FENNER

EFFECTIVE regulation of the overloading of motor trucks can be accomplished only after careful investigation and determination of the direction and amount of deviation from standards of normal practice. When we attempt to determine the facts regarding the loading of motor trucks we are handicapped by the lack of a standard which can be used as a practical basis of comparison. A motor truck is a carrying tool but not necessarily a measuring tool. It should be placed in the same general classification with the shovel and the wheelbarrow and not with the quart and peck measure and the bushel basket.

The overloading of motor trucks is due in part to the improper basis of rating and classifying the motor truck chassis in terms of the manufacturer's rated pay load capacity. The user soon learns that this rating really does not mean anything. He purchases a motor truck chassis, attaches a body which may or may not fit either the chassis or the commodity to be carried and he then loads this truck to suit himself. It would seem, indeed, that the motor truck body is the real measure of capacity which determines the size of chassis which must be used to carry it, loaded with the commodity to be hauled.

In the sale of motor transportation, the successful salesman conducts a careful survey, the results of which convince the customer that a certain type, size, capacity and weight of body is necessary to fill his transportation requirements. He sells his customer this particular type, size, capacity and weight of body and then, and not until then, is he in a position to sell the customer the proper type and size of chassis to carry this body loaded to capacity with the particular commodity that it is purchased to haul. The larger number of misfit motor trucks on the road today are the best possible examples of the other method of selling the motor truck chassis first and allowing the customer to put on the chassis any old body and load it in any old way.

Each chassis when it leaves the manufacturer's plant has a definite rated capacity for both the body weight and the weight of the load. If a particularly heavy body is mounted on, if various forms of auxiliary power devices are mounted in addition to the body and the dead weight of the body and these power devices exceed the body weight allowance determined by the chassis manufacturer, the pay load capacity must be reduced by the amount of this excess. In the case of dump bodies with hoists and transmission power take off for driving same, power driven winches, pumps, air compressors and various other forms of auxiliary power devices, this excess weight is a considerable amount and in many cases overloading would be reduced if a larger capacity chassis were used.

Manufacturers have suggested that state motor vehicle commissioners should refuse a state motor vehicle license for any truck which is not equipped with a manufacturer's caution plate properly stamped with the actual weight of the chassis, body, and load capacity. Manufacturers are now proposing to go a step further and indicate on this plate the maximum allowable gross load for the front axle, the maximum allowable gross load for the rear axle, the maximum allowable speed and the distance in which the vehicle loaded to capacity can be stopped with each set of brakes operated independently with the vehicle running at the above maximum speed on a hard, dry, level roadway. The information on this caution plate will give the owner the

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Abstract of a paper presented at the joint session of the North Central Division of the National Highway Traffic Association and the Michigan State Good Roads Association, held at Grand Rapids, Michigan, on November 21, 1922.

data he needs for painting the weight and carrying capacity on the sides of the vehicle to comply with the local state law. It will also enable the local enforcement officer to check up the distribution of weight between the axles, the maximum speed, and the condition of the braking system. A similar plate for use on home made trucks can be issued by the state motor vehicle department. The information contained on this plate will prevent the operation of improper trucks and force the proper operation of good trucks. It will put the penalty for poorly adjusted brakes and steering connections directly up to the operator where it belongs. Some states are considering the suspension of a driver's license for three months as a penalty for faulty brakes.

Let us consider briefly the line of reasoning which the owner follows as an excuse for overloading.

1. Beating the law.
2. Beating the state out of the proper amount of license fees.
3. Beating the rates of a competitor.
4. Beating the purchase price of the truck.
5. Wilful persistent overloading in the face of all the facts.

Let us briefly consider the result of these practices.

The Result of Overloading

1. The man who overloads to beat the law ultimately runs afoul the local enforcement officer. The lightest penalty, if any, forces him to leave his excess load alongside the highway and the heaviest penalty forces him to leave his truck and its load with the state authorities until such time as his case comes before the court and is decided. In some cases, this may require from six to eight weeks. In either of the above cases both the owner and the operator are subject to fine and suspension of license.

2. The man who overloads to beat the state out of the proper license fee will ultimately have to forfeit his low rating license and the money which he paid for it and be forced to take out a new license based on the gross weight which the truck was carrying at the time of his arrest and at the higher fee. Under the new license, however, he will not be allowed to carry more than the manufacturer's rate of capacity for the vehicle and its tire equipment.

3. The man who overoads to beat the rate of a competitor finds the practice unprofitable and ruinous in the long run. He does not benefit himself in any way. Rather he is benefiting his customer to whom he makes a present of the depreciation on his equipment.

4. The man who overloads to beat the purchase price of his truck or say rather to take advantage of the "overload capacity" offered by some truck salesmen is up against the general law of averages. In the end he gets just about what he pays for and no more. You can be sure that the owner who follows this practice keeps no operating costs that are worthy of the name.

5. The man who persists in wilful overloading in the face of all the facts is a menace to public safety and should permanently be refused either a vehicle or an operator's license. He has forfeited his right to the use of the highway and a few less of his kind on the highway will be a distinct benefit to highway transportation.

Allow me to quote from a statement recently issued by Mr. Joseph F. Whelan, one of the most successful and progressive professional truck operators in New York City.

"With regard to the perpetual statement that the regulation of loads to the manufacturer's rated capacity would put the truckman out of business, I would say that this is not so. Such regulation instead of putting truckmen out of business would help them materially. If it did nothing else, it would bring to a halt the activities of the irresponsible operators who have no regard either for their mortgaged equipment or for their legitimate competitors."

"If truck loads were regulated, it would mean that prices could be standardized and that much equipment that is now idle might be operated at a fair profit because additional trucks would be needed to carry the freight formerly piled haphazardly upon two or three long suffering and much abused vehicles."

Investigations concluded in some of our states show that the light and medium capacity vehicles are overloaded to a greater extent and in greater numbers than the heavy capacity vehicle. This indicates the importance of restricting loads per inch width of tire per wheel and per axle. We must recognize the four classes of tire, pneumatic, cushion, solid rubber, and metal, for regulating speed and the determination of license fees according to wheel load. We must restrict the minimum thickness of solid and cushion tires when measured between the tire flange and a flat metal surface on which the wheel stands. We must also take into account the condition of tire.

The safety of the public, the preservation of the highway, the economy of vehicle operation, the status of the operator and the successful and economic development of highway transportation all demand that the practice of overloading should be discouraged, forbidden, prohibited, and stamped out completely. Let every week be a safety week in which we conduct a campaign against overloading. If you are a truck owner and operator give your trucking department very definite instructions regarding proper loading of highway vehicles. If you purchase your trucking on a rental basis, refuse to patronize those professional truckmen who persist in overloading.

How To Stop Overloading

Put it up to your local motor truck association to stop this practice of overloading or take the consequences of a concerted action of the local automobile owner's association and the local chamber of commerce to report to the enforcement officers every truck which shows the slightest evidence of being loaded beyond its capacity.

Let us take all the pleasure and the satisfaction out of overloading. Then the chap who has been overloading just to beat the game will quit and the chap who is really forced by circumstances to haul more than the rated capacity of his present vehicle will either buy a larger vehicle or a semi-trailer and mount the front end of this trailer on a fifth wheel attached to the frame of his present vehicle over its rear axle. By this means he can double the capacity of his present vehicle and by distributing his gross load over six wheels, four of which are rolling and only two driven, he can keep within the wheel weight restrictions of the state law and the manufacturer's rated capacity of the truck, help to preserve the safety of the public and the best interests of highway transportation.

The motor vehicle industry stands solidly behind the rigid enforcement of the provisions of the Proposed Uniform Vehicle Law and the existing state laws. It condemns overloading and overspeeding unreservedly and will co-operate actively in every movement to regulate loads and speeds of motor trucks on the highway.

Current Events in the Field of Highway Engineering and Transport

War Department Considering Road Development for National Defense

Road development needed for national defense as planned by the General Staff of the Army has rcently been indicated to the Department of Agriculture by the Secretary of War and the information has been placed in the hands of the engineers of the U. S. Bureau of Public Roads who are at the present time getting into final shape the plan for the system of Federal-aid highways. This system will consist of approximately 180,000 miles of road, so laid out as to serve all parts of the country and will be built by the States in conjunction with Federal aid.

The General Staff has been investigating the subject since 1919, the Bureau of Public Roads collaborating. Briefly summarized, the report made is as follows: There are certain vital areas along the boundaries of the United States against which any invasion will probably be directed. These areas have been outlined by the General Staff. For military purposes they should be connected with the centers of production and storage and industrial centers. The roads will then become strategic lines of supply and will usually conform with roads located for other purposes. Transcontinental routes are of no particular value for military purposes.

The plan submitted by the War Department shows important centers that should be connected but does not give any detailed routes. Engineers of the bureau state that these points can be connected by roads without any serious dislocation of the plan of development for other purposes and that in general the military need for roads conforms with surprising closeness to the commercial and economic needs. It is thought that the plan submitted can be embodied in the Federal-aid highway system and thus make the system an important factor in our plan of national defense.

Roads of a purely military nature such as those leading to coast fortifications have not been included in the plan submitted and will be handled by the War Department as heretofore.

TOLLS ON ROADS AND BRIDGES WOULD REDUCE CONSTRUCTION COSTS

Minnesota could collect more than $5,000,000 a month by applying on its 7,000 miles of trunk highways the road and bridge tolls collected on a road in a certain southern state, a former resident of Minnesota writes in a recent state trunk highway bulletin.

"With a few friends, I recently made an automobile trip to a town 30 miles away to see a football game and we paid $2.10 in road and bridge tolls," the letter reads. "Out of curiosity, I figured what the same rate of 3½ cents a mile would mean on the average of 710 vehicles using the so-called Babcock roads back home. The totasl of $174,950 a day or $63,491,750 a year may afford Minnesota auto tax payers something to think about, and the tolls here may partly explain why this state with more than $100,000,000 for roads is starting to pull itself out of the mud and abolish the tolls."

The bulletin adds an example of how Minnesota car owners are not obliged to take generally antiquated toll schedules to figure big savings on the better roads. Nearly 350,000 cars and trucks owned in the state and averaging 5,000 miles each, it states, make a total of 1,750,000,000 motor vehicle miles a year. If road betterments are saving them only one cent a mile, or a tenth of the accepted operating cost of 10 cents a mile for the average motol vehicle, their costs are being cut $17,500,000 a year or nearly three times the amount of motor vehicle taxes paid, it concludes.

A recent bulletin gave practical test figures showing that the hole cost, interest included, of paving the entire 7,000 miles system of trunk highways, could be paid for with resulting savings on gasoline and tires in less than five years.

LOW PRICES CONTINUE ON MINNESOTA ROAD PROJECT

Low prices continuing on state highway projects, Charles M. Babcock, state highway commissioner of Minnesota recently made public awards of several important contracts, nearly all for new bridges on the trunk system.

The largest contract is for 3 miles of grading, 3 bridges, and culverts, at Chaska Hill on Trunk Highway No. 12, awarded to the George J. Grant Construction Co., St. Paul, at $53,715. Other bridge contracts were awarded as follows:

T. H. No. 1—In Owatonna, over Straight river, 120-ft. concrete bridge, 24-ft. roadway and 8-ft. sidewalk, to the Widell Construction Co., Mankato, at $19,989.

T. H. No. 5—At LeSueur, over Minnesota river, 400-ft. steel bridge, creosoted wood block floor, to Wausau Bridge Co., Wausau, Wis., at $52,188.

T. H. No. 6—At Mississippi Junction, over Swan river, 75-ft. steel and timber bridge, 20-ft. roadway, to W. O. James, Minneapolis, at $2,605.

T. H. No. 8—Between Bemidji and Cass Lake, over Mississippi river, 225-ft. bridge, 3 spans, 20-ft. roadway, to Minneapolis Bridge Co., Minneapolis, at $23,000.

T. H. No. 10— East of Maple Plains, 10x6-ft. box cllvert on timber piling, to W. O. James, Minneapolis, at $2,730.

T. H. No. 11—Between Baudette and Spooner, over Baudette river, 400-ft. steel bridge, 5 spans, 20-ft. roadway, two 5-ft. walks, to Minneapolis Bridge Co., at $44,850.

T. H. No. 11—Near Ericksburg, 150-ft. pile trestle, 20-ft. roadway, to W. O. James, Minneapolis, at $3,590.

T. H. No. 16—In Windom, over Des Moines river, 120-ft. concrete bridge, 3 spans, and over boat channel, 50-ft. concrete girder, each with 24-ft. roadway and two 5-ft. walks, to Ormond & Fallar, Rochester, at $33,655.

T. H. No. 17—South of Marshall, double 20-ft. concrete slab span, 20-ft. roadway, to Bladholm Bros., Marshall, at $3,998.

Construction of these bridges is to be pushed without unnecessary delays, highway officials said, that the public may use them on the earliest dates possible.

TRAFFIC MARKING PAINT TESTS RECENTLY COMPLETED

Two tests of the Traffic Marking white paint manufactured by E. I. du Pont de Nemours & Company have just been completed. One of the tests was made by the Pennsylvania State Highway Department where the white traffic paint was laid on two separate locations—one on the brick road leading from Harrisburg to Carlisle at the western approach of the Susquehanna River Bridge and the other on Route No. 1 just above Rockville. The test proved that it kept its color on oil surface roads in better fashion than any paint hitherto used.

Another test was made by the Massachusetts State Highway Commission and a favorable report was made by that body also on the durability of the paint.

There is a constant demand for white traffic paint from municipalities and highway bodies for the purpose of marking out zones along streets and highways. This demand has become so large that there is at least one firm specializing in this kind of paint.

ILLINOIS MAKING PROGRESS MAP

A huge illuminated map showing the progress of all state hard roads under construction is under preparation by the Illinois State Highway Division for exhibit at county fairs throughout the state.

The map also will show the amount of grading and the contracts awarded. Each of these will be shown by different colored lights. Another map showing the location of material plants from which come the concrete, stone and other materials used in the building of Illinois' great road system will be exhibited.

With these maps the department will send out tinted pictures showing views of various highways of the state. Models are to be prepared of bridges and of present standards of pavement.

COLORADO DOUBLES MILEAGE OF ROADS IN SEVEN YEARS

Colorado has more than doubled its mileage of improved road in the last seven years, according to the U. S. Bureau of Public Roads, which has made an extensive investigation as to the highway mileage and revenue of the State.

In 1914 there was 13,298 miles of improved road and a total of 39,780 miles, while in 1921 the improved mileage had increased to 29,540 miles and a total of 48,143 miles.

The improved road at the present time is classified as follows: Graded and drained, 24,941 miles; sand, clay, and gravel, 4,397 miles; macadam, 131 miles; other types of surfacing, 71 miles.

While most of the improved road in

this State is what is known as low-type road, the fact that more than 60 per cent of the total mileage has been improved constitutes a record that will be envied by many.

For each square mile of area the road revenue amounts to $85.56, and there is one-half mile of road. The total road revenue amounts to $9.35 per capita, $182.07 per mile of road, and totals $8,765,443.

GASOLINE SAVINGS WOULD PAVE ROADS

Highway Figures Show Gains Possible from Buying Good Roads Instead of Extra Gasoline

Possible savings on gasoline alone, in the next ten years at ,present prices would pay the whole cost of paving the entire 7000-mile Minnesota system of trunk highways, according to recent practical tests made by the Iowa State College. Expert engineers report that equal savings can be made on tires with paved, against unpaved, roads, and this added, the possible savings would equal the paving costs in five years. Even greater savings possible on the life of every car and the comfort and convenience afforded by hard-surfaced highways would represent net gains, they assert.

Charles M. Babcock, state highway commissioner, made it clear that there is no immediate plan to pave 7000 miles or even 700 miles on the trunk system, and that the figures are applied to the Minnesota highway program to emphasize that the proposed bond issues to speed up betterments are "just good business."

Iowa test averages showed that a gallon of gasoline is the motor fuel necessary to transport one ton 14 miles on an earth road, 21 miles on a gravel road and 31 miles on a concrete pavement. With gasoline at 24 cents a gallon, ton mile fuel costs are 1.71 cents on earth. 1.15 cents on gravel and .77 cents on paved roads. Further, the tests show possible savings of .56 cents a ton mile on gravel over earth roads, .94 cents on pavement over earth roads and .38 cents on pavement over gravel roads. The weight of the average vehicle is placed at 1.36 tons. These basic figures make it easy to figure with fair accuracy the gasoline savings possible from improvement of any road on which is known the number of motor vehicles using it daily.

Applied to the Minnesota trunk highway system, the test figures indicate a fuel cost of motor vehicle operation, per ton mile with 24-cent gasoline, of 66-hundredths of a cent less on a concrete road than on the average unpaved road in the state. With traffic averages of 710 vehicles and 966 tons a day on the Minnesota trunk highways, the gasoline saving alone would be $2.325 a year, plus $675 saving on maintenance on paving, or a total of $3,000 a mile saved annually.

Interest charges included, concrete pavement in Minnesota costs $30,000 a mile. So the possible savings on gasoline with hard-surfaced roads, with maintenance costs reduced, would in ten years at the present price of gasoline, cover the gross cost of extending paving over all of the 7,000-mile state highway system.

Commenting on the proposals to be made to the legislature, Commissioner Babcock said:

"The highway department will recommend first issues of state highway bonds because it believes the proposal just good business and what a good manager would urge upon stockholders in a private enterprise under like conditions. The public as good roads stockholders acting through the senators and representatives corresponding to the board of directors in a private business must decide whether the proposition is timely. It will stand solely on its merits.

"The successful business man borrows funds when he finds he can use them to build economically and advantageously. Minnesota with a credit of $20 per capita and only $8.14 of debt or a net credit of nearly $12 per capita, is in better position to borrow money for needed highway improvements than many other states now going on with much larger highway funds and programs. Highway bond and other recommendations to be made by this department will not add one cent to taxes. Better roads already are returning to average car and truck owners more than they pay in motor vehicle taxes and since the state assumed the expense of building and maintaining the more expensive main roads, county, township and city-village levies for road and bridge purposes are rapidly going down. Direct taxes for roads in Minnesota are being lowered for the first time in the history of the state.

CALENDAR OF COMING MEETINGS

Jan. 11-12—FEDERATED AMERICAN ENGINEERING SOCITIES. Annual meeting, Washington, D. C.

Jan. 15-17—NATIONAL CRUSHED STONE ASSOCIATION. Annual convention, Chicago, Ill.

Jan. 15-18 — AMERICAN ROAD BUILDERS ASSOCIATION. Annual convention, Chicago, Ill.

Jan. 17-18—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, New York City.

Jan. 22-26—AMERICAN CONCRETE INSTITUTE. Annual convention, Cincinnati, Ohio.

Jan. 23-25—ILLINOIS SOCIETY OF ENGINEERS. Annual meeting, Peoria, Ill.

Jan. 23-26—IOWA ENGINEERING SOCIETY. Annual Meeting, Des Moines, Ia

Jan. 24—BOSTON SOCIETY OF CIVIL ENGINEERS. Boston Mass.

Jan. 25-26—SOUTH ATLANTIC COASTAL HIGHWAY ASSOCIATION. Charleston, S. C.

Jan. 27—NORTHEASTERN SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, Boston, Mass

Jan. 30-Feb. 3—ASSOCIATED GENERAL CONTRACTORS OF AMERICA Annual meeting, Los Angeles, Calif.

AUSTIN MACHINERY CORPORATION CONSOLIDATES OFFICES

The Austin Machinery Corporation has consolidated its main sales offices at Chicago with its Engineering and Production Departments at 3500 Dorr Street, Toledo, Ohio.

This step toward the unification of affairs of the Company will increase service in all its Branches and lend dispatch to the handling of orders for both machines and repairs. It will thus be of mutual benefit to both the Austin Organization and its many customers.

A Branch Sales Office will still be maintained, however, at Chicago, Suite 603, Railway Exchange Building, for the convenience of contractors in and near Chicago.

MINNESOTA GOOD ROADS PROPOSALS TO BE MADE TO NEXT LEGISLATURE ANNOUNCED BY HIGHWAY EXECUTIVE

In addition to the plans for financing the Minnesota state highway program during 1923 and 1924 already made public, Charles M. Babcock, state highway commissioner, this week announced other recommendations to be presented by the highway department to the state legislature early in January.

Under the policy of promoting public co-operation in the good roads plan, the commissioner invited comments on the proposals and added suggestions for new laws and changes in the old ones. They should be sent to the highway department, 1246 University avenue, St. Paul, Everyone will receive due consideration, Mr. Babcock said, but to acknowledge all may prove too big an undertaking.

A new law will be asked to permit cities and villages which are willing to pay the interest on the investment until such time as the improvement is reached on the regular state program, to pave streets on the trunk highway system within their limits. Many towns now are putting off paving until the state is ready to pave its 18-foot strip on their streets. Commissioner Babcock wants the road plan to promote instead of hindering improvements and believes the new legislation is only fair to progressive towns.

The present limit on expenditures for paving—20 per cent of the state highway construction fund—will be taken off, if the highway department recommendation prevails in the legislature. Paving is and will be built only where it is necessary to stop waste of money for gravel on heavy traffic sections, highway officials assert. Where more than 1000 vehicles a day use a road and the maintenance cost runs over $700 a mile each year, they add, the economical and most satisfactory way is to pave the sections.

Wagons and buggies, as well as trucks and automobiles, must carry lights when on the highways after dark, upon passage of another law proposed for common public welfare. Commissioner Babcock said a regulation of that kind is favored unanimously by many farmers with whom he has discussed the proposal. Those farmers believe that the repeal of the law a few years ago was a mistake and for that reason they are expected to give their full support to its reenactment.

Claiming that road betterments already are reducing repair, gasoline and tire expenses for car owners and for that reason that all cars should bear a reasonable share of the cost of highway improvements, Commissioner Babcock will ask that the "tax exempt" tags to be abolished. Every motor vehicle should pay its way on the better roads in return for the savings afforded its owner, according to state highway officials and engineers, all of whom bought the regular tags at personal expense for state-owned cars they use in their work.

Commissions for motorcyclemen policing the highways and fees for local justices will become largely things of the past through adoption of another proposal by the highway department to the legislature. The plan is to take away the incentives under which some local officials have been making easy money at the expense of the reputations of their communities among tourists and other highway users. The change is for the benefit of sane drivers, and not to encourage speeding or other traffic law violations.

ISSUES "GOOD ROADS PRIMER" FOR PENNSYLVANIA

The State Highway Department of Pennsylvania recently received from a Chamber of Commerce a number of queries which when answered constituted what Assistant State Highway Commissioner George H. Biles believes is a first-class Pennsylvania good roads primer. The "primer" is as follows:

Q. How many miles of road are there in Pennsylvania?

A. Approximately 90,000. Of this total 10,320 miles comprise the State Highway system. The major portion of the balance is township roads; and there are several hundred miles of roads under the jurisdiction of county commissioners.

Q. How many miles of improved highway are there in Pennsylvania?

A. Approximately 5000 miles of the State Highway system are improved and in addition there are scattered sections of county and township roads totalling approximately 3000 miles. These improved township and county roads are not all of a durable type. In Lancaster, Montgomery, Delaware and other eastern counties, for example, they are stoned roads.

Q. What is a state-aid road?

A. State-aid highways are those in which the state has joined with the local authorities in the cost of the improvement.

Q. What is the State-aid mileage in Pennsylvania?

A. Approximately 415 miles.

Q. What are the types of the improved State Highways?

A. On January 1, 1922, there were 4595 miles of macadam, concrete, asphalt, brick, wood and stone pavements on the State highway system. There were over 400 miles of similarly improved State-aid highways.

Q. Of this 4595 miles of improved State Highways, how much was macadam?

A. On January 1, 1922, the macadamized State highway totalled 2828 miles.

Q. That left a balance on State Highways of 1757 miles of asphalt, concrete, vitrified block, wood and stone block. Of this total how many miles were put down by the State Highway Department during the present administration?

A. The 1757 miles was as of January 1, 1922. To that total should be added 500 miles of construction during the 1922 season, giving a total of 2257 miles. Of this total 1843 miles were put down during the construction seasons of 1919, 1920, 1921 and 1922.

Q. What work has been done by the Maintenance Division of the State Highway Department during the last four years?

A. In 1919, 1920, 1921 and 1922 the maintenance forces resurfaced 796 miles of macadam roadway and put down 1060 miles of unbound macadam. During the 1922 construction season the maintenance forces built ten miles of durable highway.

Q. Has the State Highway Department itself built any other road than that built by the maintenance forces?

A. The Department organized its Construction Bureau in 1920. During 1920, 1921 and 1922 the Construction Bureau built 55 miles of durable highway in various parts of Pennsylvania. Its most notable performance was the construction of the difficult highway from Trout Run north to Blossburg.

Q. Where is the longest continuous stretch of concrete in Pennsylvania?

A. At this time it is the roadway which begins at the Maryland line, continuing north through Gettysburg to a point near Harrisburg. This concrete section is approximately 39 miles in length. Upon the completion early in 1923 of a project now under way between Liverpool and Selinsgrove, along the Susquehanna River; the concrete beginning at the town of Dauphin, Dauphin County, and ending at Selinsgrove will approximate 60 miles in length.

Q. What is the longest possible journey that can be made in Pennsylvania at this time over continuous improved highway?

A. Starting at Greenville, Mercer County, and going via Mercer and Harrisville to Butler and Pittsburgh; thence east to Philadelphia, via Chambersburg and Harrisburg; thence north through Doylestown, Easton, Stroudsburg and Scranton to the New York line, south of Binghamton, a total of 600 miles. Early in 1923 this distance will be increased when construction now under way is completed between Cambridge Springs and Greenville. It will then be possible to go from Greenville to Erie and thence east to the New York line. This will add 90 miles to the mileage now completed, giving a total of 690 miles in a straightaway.

LEE HIGHWAY ASSOCIATION TO HOLD ANNUAL CONVENTION IN JANUARY

The Lee Highway Association announces its third annual convention at Little Rock January 18-20, 1923. The growth of the organization has been phenomenal. During its first year it was chiefly a Virginia enterprise, during 1922 it became a Virginia-Tennessee project, now its work is national in scope. In point of numerical and financial strength, in prestige and popularity and in ability to get results in the way of speeding up road construction the Association has taken first rank.

Shorter by 300 miles than any southern competitor Lee Highway follows a southwest diagonal from Washington by Roanoke and Bristol, Virginia, and Knoxville and Chattanooga, Tenn., to Muscle Shoals, Alabama thence by Iuka and Corinth, Mississippi to Memphis, Tennessee; thence through Little Rock, Hot Springs and De Queen, Arkansas into Oklahoma. It follows westward up the famous Red River Valley through Idabel, Hugo, Durant Madill, Ardmore, Duncan, Lawton and Frederick, Oklahoma, thence crosses Red River into Texas and passes through Vernon, Crowell, Paducah, Matador, Floydada, Plainview, Olton and Muleshoe to Farwell, Texas; thence through Clovis, Portales, Roswell and Alamagordo, New Mexico to El Paso, Texas, thence by Mesilla Park, Las Cruces, Deming and Lordsburg, New Mexico and Globe, Phoenix and Yuma, Arizona to San Diego, California.

Early construction of all gaps is assured by the fact that every mile of this road is included in the seven per cent system entitled to federal aid. Faster than any railroad was ever pushed from the Atlantic to the Pacific this highway is being pushed to completion. Even now it is an open and usable road all the way, though excessive rain makes the going heavy in dirt road sections, east of Paducah, Texas. Westward from Paducah the rain-fall is slight and travel is uninterrupted.

Personal Mention

C. E. Grafton, county road engineer of Hancock County, W. Va., has resigned and will leave, November 26, for San Diego, Calif., to spend the winter.

J. S. Bentley, formerly a field engineer of the Kentucky State Highway Department, has been appointed county road engineer of Pike County, Ky., and will be in charge of road construction in that county after January 1, 1923. This is Mr. Bentley's third appointment to this office, his first appointment having been made in 1916. T

Guy Hall has been appointed project engineer with the Missouri State Highway Commission. He is in charge of work in Audrain County and is stationed at Mexico, Mo. Prior to October 1 Mr. Hall was with the Kansas State Highway Commission.

B. E. Clark, for the past two years state highway commissioner of Oklahoma, has resigned, his resignation to become immediately effective. It is understood he will become associated with the Portland Cement Association in Oklahoma territory.

OFFICIAL PROPOSALS

HIGHWAY WORK
Notice to Contractors

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M., on Tuesday, December 19. 1922, for the improvement of highways in the following counties:

ALBANY	(one highway: 0.23)
CATTARAUGUS	(one highway: 0.15)
MONROE	(one highway: 0.12)
ONTARIO	(one highway: 0.41)
OTESEGO	(one highway: 0.48)
STEUBEN	(one highway: 4.24)
SUFFOLK	(two highways: Gravity Concrete Retaining wall)

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STEUBEN	(one contract: 3.00)
SUFFOLK	(one contract: 4.50)
TIOGA	(one contract: 3.18)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose divison the roads are to be mproved or reconstructed. The addresses of the Division Engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

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CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor

E. W. TREE, Managing Editor

Vol. LXIII DECEMBER 20, 1922 No. 25

TABLE OF CONTENTS

Refined Tars in Maintenance and Construction . . 207
By Philip P. Sharples

Standardizing Lights for Highway Vehicles . . . 209
By David Beecroft

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Road Material Tests and Research Considerably Advanced During 1922 211

Minnesota Good Roads Program Up to Lawmakers 211

Indiana Reclaims Old Bridge With Saving of 20 Per Cent. Over a New Structure 211

United States Civil Service Examination for Highway Engineer 212

Canadian Minister of Highway Inspects Ontario Road System 212

Fred A. Marsh Dies 212

Road Development in Indiana 212

Personal Mention 212

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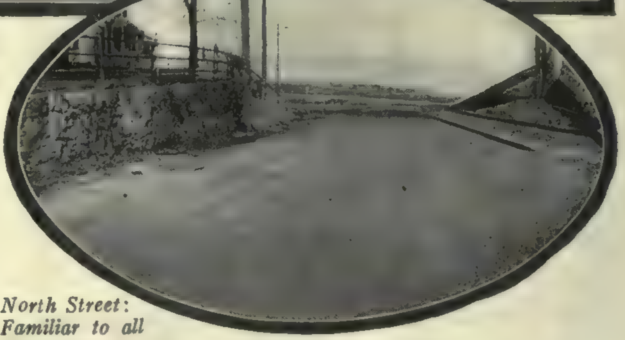

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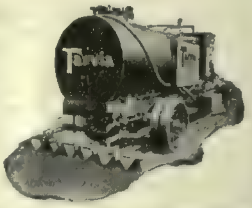

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GOOD ROADS
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Refined Tars in Maintenance and Construction

By PHILIP P. SHARPLES
Technical Advisor, The Barrett Company

THE maintenance problem in the long run is the most important problem that faces the road engineer. Just at present it is being neglected by many engineers owing to the clamor for new construction. New construction carries with it an interest and a prestige that are sadly lacking in maintenance problems. Yet it is not conceivable that any road supervising body will construct or reconstruct fundamentally more than 5 per cent. of its mileage annually. This leaves the remaining 95 per cent. that must be taken care of annually, if the original investment is to be preserved. Stated in figures, the State Highway Department and the counties of New Jersey might build 150 miles of road, but they have some 2,850 miles to maintain.

Maintenance Costs Are Unknown

The cost of maintaining modern highways under modern traffic conditions is an unknown quantity. An analysis of the figures of any of our State Highway Departments leads to no just conclusion. Figures may be twisted almost any way to prove any particular proposition. I venture to say, however, that in the long run, provided a road is not overloaded for its type, and provided that it is carrying the load of traffic for which it was designed, that the cost of upkeep through a period of say 20 years, will be somewhat proportional to the original cost of the road. I know this is diametrically opposed to the prevailing popular notion on this subject, but an analysis of figures covering roads on which the traffic conditions are manifest, leads to this conclusion. On the one hand, extremely high costs are assigned at present to the simpler forms of paving like macadam, and extremely low costs are assigned to some of the modern rigid types of paving. Unless sufficient time has elapsed to prove the length of life of the rigid type road, it would be unsafe to predict the maintenance cost. On the other hand, the costs on the macadam type are generally arrived at by adding in the cost of rebuilding, or reconstructing an old worn-out macadam to resist modern traffic.

In almost any community where macadam roads already exist, a little study will show that this type of road when properly looked after, is adequately carrying a large traffic at a low cost per ton mile. Their unsatisfactory condition in most cases is due to utter neglect and a thorough misunderstanding of the economic factors in the case. A little consideration will show that if it is possible to make a macadam road stand the traffic imposed upon it, that it pays handsomely to spend even as much as $1,000 or $1,500 a mile per year on it, rather than to replace it with a pavement that would cost $40,000 or $50,000 per mile.

The rehabilitating and traffic-proofing of the macadam road is peculiarly the province for tar materials. Much study has been given to the production of materials suitable for patching work, for surface treating work and for use as a binder in cheaply constructed bituminous macadam tops that are suitable for strengthening old macadam roads.

The maintenance of macadam roads by surface treatments was originated with tar materials. Improvement in the refined tars and in the equipment used, has kept these materials at the front for this class of work. The tars have a penetrating power beyond all other bituminous materials used for this purpose and also have the peculiar quality of setting up, that seems to render them to a considerable extent immune from shoving and waving troubles incident to the use of other bituminous materials.

The Value of Surface Treatments

The use of surface treatments cannot produce a good road out of one that is worn out. They cannot give a smooth surface to a road that is in need of surface repair. Surface treatments can, however, preserve macadam roads which are strong enough to uphold the traffic that goes upon them from the surface wear and tear of self-propelling vehicles. In other words, surface treatments should be applied to macadam roads for their protection before the roads have worn out. If the macadam has worn thin or has ground up internally, it must be rebuilt before the surface treatment will give satisfaction. As a rule, surface treatments in New Jersey on old macadam roads have not given as good results as surface treatments in New England. The reason must be assigned to the almost universal practice of using clay as a binder for macadam roads in New Jersey, a practice that was never carried out in New England. New Jersey with the finest trap rocks in the world for building macadam should have the very best results with surface treatments if the roads are built properly to receive them. The macadam road with a surface treatment is still the most economical type to build for many types of traffic. It cannot be excelled in first cost or in low cost of maintenance where there is a preponderance of light weight traffic.

Abstracted from "The Highway."

Two types of tar materials have been developed for surface treatment; a material which must be heated before application, and a material which is thin enough to apply cold. Under general conditions, the material which is to be applied cold gives the lowest yearly maintenance cost and is to be preferred. For certain park and boulevard conditions, however, the hot surface treatment gives the lowest unit cost through a series of years. The local factors must be thoroughly studied to see whether it is more economical to pay less for a comparatively short-lived treatment or to pay more for a more lasting treatment. The material applied hot may sometimes be used advantageously with semi-surfacing methods. Its greater binding power and longer lasting qualities make it particularly adapted for this purpose.

The Cost of Surface Treatment

The cost of surface treatments varies with the condition of the surface, the amount of refined tar required and the type of work decided upon. Simple surface treatments of refined tar applied cold over roads already in good condition may be made very cheaply. However, if much repair work is to be done, or if the surface of the road must be worked over before the bituminous material is applied, the cost will mount rapidly. If the work required on the surface is extensive, it may be very much cheaper in the long run to scarify the surface, add new stone and practically build a new top by the penetration method. In this case, a heavier material, a road binder, is required.

It is quite astonishing how much can be done by the use of the modern repair roller fitted with a steam scarifier. Too little attention has been given, especially by municipal and town engineers, to the possibilities of this type of work using tar binders, and few are aware of the low cost coupled with extremely satisfactory results that can be obtained by these methods, especially where truck service supplying hot binders can be obtained.

The tar binders have proved themselves equally serviceable in the building of new macadam roads. Tar binder has peculiar advantages for use in penetration work; it is strongly adhesive to cold stone; it re-unites easily if the bond is broken during rolling; it is easily liquified by steam heat so that it may be applied effectively by spraying equipment; and it can be used successfully with a great variety of stone. It also can be used earlier in the season and later in the season than other bituminous materials since it is less affected in its application by cold and dampness.

The penetration method is looked upon by some as a very crude operation and therefore not worthy of much study. It is true that it is a form of construction easily mastered but that does not prevent penetration work being badly done in many instances. The cardinal principles to be observed are simple, but certain fundamentals must be carefully carried out to produce perfect pavements. Really good penetration work, constructed with rocks like the Jersey trap rocks, carry a surprisingly heavy traffic at a low cost of maintenance. Stretches of bituminous macadam on the most traveled Maine State Highways have shown the lowest annual maintenance cost for any type of pavement. The type has a certain resiliency to it which enables it to stand temporarily overloading without damage, better than more rigid types of pavement. Even when damaged, provided it was originally well built, it can be brought back into serviceable condition at a comparatively low cost. This is not true of other types of paving of equal resisting power.

Penetration macadam with tar binder has proved a very efficacious method for widening existing hard surface types of paving. It is also employed, as on the Lincoln Highway near Metuchen, for shoulder work on new pavements. The shoulders of hard surfaced pavements with definite edges are peculiarly hard to maintain: Wheels dropping off of the hard surface, quickly form dangerous ruts. A strip of bituminous macadam, however, resists the occasional wheel dropping off the surface, and may be maintained level with the pavement at comparatively slight expense.

Where traffic becomes more crowded, the bituminous shoulder in reality provides a practical widening of the pavement at small cost. The methods employed in penetration macadam construction are easily modified so that strips, even as narrow as 18 inches may be economically constructed. In Wayne County, Michigan, some 60 miles of this type of shoulder have been installed with satisfactory results.

Repair work of all kinds is at present being carried on successfully with tar materials. The older types of materials, the hot and cold surface treatments and the binder, are used in many kinds of repair work and in protecting other types of pavement than macadam. The cold surface treatment has been found very effective in protecting certain types of gravel. The gravel, however, must be made up of a considerable proportion of pebbles one inch or thereabouts, and must contain a minimum amount of clay, the limit of which is usually set at 15 per cent. The nearer the gravel approaches a macadam pavement in construction, the more sure the surface treatment is to be successful. Extremely interesting work along these lines has been done in Maine and New Hampshire in protecting the State Trunk Lines from the summer automobile traffic, where the resistance of the gravel road has been increased from 200 or 300 automobiles a day to 2,000 or 3,000 automobiles a day. The methods have, however, not been found applicable to the gravel of Southern New Jersey.

Cold Surface Methods

Cold surface treatments have been developed to successfully take care of bituminous macadam, bituminous concrete and even wood block pavements.

The low cost of maintenance of surface treatments and of penetration macadam is dependent largely on well developed patrol or gang maintenance systems. Surface treatments are liable to give way to weak spots in the road below and unless these are early patched, serious damage may result to the road. The work of patrol and gang maintenance has been made much more effective by the development of cold patching material. A cut-back tar product has proved particularly effective. The tar material mixes easily with the stone, seasons out quickly, and produces a patching compound which sets up solidly in the patch with little or no tendency to develop waves. Since it may be used cold, barrels of the material may be stored and used at convenient places along the roads, ready at all times for instant use. The cold patching material and mineral aggregate may also be mixed beforehand at central points, stored for future use, and carted out as required upon the road. Central storage plants, using an ordinary small concrete mixer to mix the batches have proved particularly effective in town and city work. With this material available, there is no excuse for any city or town neglecting its repair work and letting the streets get into condition dangerous for traffic. Properly mixed and graded material may often be used in making temporary repairs on heavy duty pavements, until it is convenient to put in more permanent work. It has been used successfully on streets like Broad street, Philadelphia, carrying the heaviest traffic of a large city. Some of these temporary patches, overlooked in the permanent repairs, have carried traffic for a year or more.

The best results can only be obtained by careful attention to detail. The mixes must be rightly proportioned, and the work carried out in an intelligent way. Many cities now have repair gangs trained in this kind of work which patrol the streets carefully in order to make quick repairs wherever necessary. This kind of work has been found to pay handsomely and the repair gangs' expenses are saved many times over in the longer service given by the pavement, and the pavements instead of being spasmodically good and generally bad ,are at all times kept in good condition.

Standardizing Lights for Highway Vehicles

By DAVID BEECROFT

Vice-President, North Atlantic Division National Highway Traffic Association.

MUCH has been done with our highways to make them safer. Much has been done with vehicular lighting but much yet remains to be accomplished. Painting the center line of horizontal and vertical curves has already accomplished admirable results. A lamentable lack of standardization still exists in the marking of "steep hills," "dangerous curves" and "dangerous highway intersections," etc. Our highway signals are too frequently obscured if not often completely hidden by business road signs that are too often placed on curves and at other danger points, where all such should be legislated against and only the use of highway marking signs permitted.

The writer was asked to give special considerations to the question of motor trucks and with this thought in mind communicated with various states on this particular subject and the varying character of replies indicated that no comprehensive study and classifications of accidents have been entered upon by many states—a work that would seem highly necessary if a complete interpretation is to be arrived at.

The Present Situation

We are having accidents with cars and vehicles of all classes. There is no general agreement as to the cause of these accidents. In Michigan Charles J. De Land, Secretary of State, says that accidents are occurring continually on the highways of the state due to improper equipment of both motor truck and passenger cars. Secretary DeLand goes on to state that no other law in the statute books of Michigan is more openly violated than that regulating lights on motor vehicles of all descriptions. He makes, however, no mention of lights on horse drawn vehicles or the absence of them. That is a factor in the category of accidents. But, he continues: Trucks are being operated on the highways with a searchlight on the cab which is like a blinding headlight to persons approaching in the opposite direction and these same trucks very often have a big trailer with no light of any description on the rear to say nothing of the width of the body. My suggestion is some drastic legislation that will compel owners and drivers of trucks to equip same with two white lights on front that can be turned on the road and with a red or green light on each side of the truck on the rear.

So much for the views from Michigan. New York state has a different report. Bert Lord, the director of Motor Vehicle Bureau of the State of New York says: "I have no information on file as to accidents, however, I am aware there have been a number of accidents due to wide trucks, and on account of it a bill was introduced requiring a green light on the outer left hand corner of the truck so that motorists could know the width of the truck when approaching it. The measure did not become a law and I do not think I would approve the green light. However, a white light possibly would be good." I am glad to see Mr. Lord opposed to green light for reasons to be given later.

What Connecticut Has Done

The State of Maryland has a system of highways used a great deal by motor trucks but D. Marshall Shroeder, deputy commissioner of motor vehicles cannot recall any accidents due to the width of motor trucks. His office does not classify accidents or collisions between different types of motor vehicles. Mr. Shroeder says: "I do believe that it is an excellent plan to suggest that all motor vehicles carry a light similar to a parking light on the extreme left showing white in front and red to the rear."

The State Commissioner of Connecticut has gone further than any other state in a study of accidents and for two years had investigated every accident occurring on the highways of the state and has classified these accident showing the number to which the blame is due to motor cars, motor trucks, motor cycles, trolley cars, horse vehicles, railroads, pedestrians, etc. This analysis for 1921, shows that approximately 91 per cent. of all accidents on the highways can be eliminated by highway improvements, better highway lighting, improved signals, better lighting of motor vehicles, improved regulation of all vehicles and general education of those using the highway. The Commissioner of Motor Vehicles believes that only 7 per cent of all highway accidents cannot be avoided. Because of the study that has been given to this subject in Connecticut we should hear carefully what the Commissioner of Motor Vehicles has to say. He exhibits that great qualification of meekness, admitting that the more he has studied the subject, the less is he willing to attempt to settle the entire question by regulating lights on different classes of vehicles. He says: "I need to be convinced that accidents happen on account of the absence of some light which will indicate the character of the vehicle and while I have not our statistics on this point yet—off hand, I am doubtful as to whether they will bear out the suggestion that has been made to the effect that

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Abstract of a paper presented at the joint session of the North Central Division of the National Highway Traffic Association and the Michigan State oGod Roads Associaton held at Grand Rapids, Michigan, November 21st, 1922.

lack of lights indicating truck width is a fruitful cause of accidents."

These words from Robbins D. Stoeckel, Commissioner of Motor Vehicles for the State of Connecticut are deserving of careful consideration as this state is crossed by the highways between New York City and and Boston, in fact by the highways between New York City and the greater part of New England. These highways have heavy motor truck traffic perhaps as heavy as any other state in the Union.

In the Commonwealth of Massachusetts the green light on the extreme left side of the truck is favored. It is considered a convenience as well as a factor of safety. The State of Delaware reports several accidents due to lights on motor trucks. Pennsylvania has no record of any special accidents caused by motorists not being familiar with the widths of motor trucks. Minnesota has had very few accidents due to the width of trucks and has no regulations calling for lights to indicate truck width, but Secretary of State Mike Holm adds, "We have had very few accidents due to truck width."

Time will not permit further comment on the experience of the different states but in no others can evidence be secured that width of truck has been a special factor in accidents. After reading the opinions of motor vehicle commissioners, in half a dozen states, that now have heavy motor truck travel, only one conclusion can be reached, viz: perhaps with the single exception of Connecticut no adequate analysis of accidents has been made to establish any relationship between lighting of vehicles and the accidents.

Overlighting as Well as Underlighting

Perhaps up to the present we represent the concensus of opinion by stating that motor cars are too often overlighted and motor trucks generally underlighted. We rarely meet the motor truck with its dazzling headlight, but too frequently we meet the inefficient pair of oil lights on the truck that are not adequate and are in reality useless except as signal lights.

Let us now briefly consider the highways on which these vehicles operate day and night. Some of these roadways have become virtually highroads for commodity and passenger transport, similar to our railroad lines. They have quite entirely outgrown the use made of them a few years ago, yet notwithstanding this transition they are not lighted in any sense commensurate with the travel on them. Perhaps the road suraface has been improved, but more equipment is needed along those highroads of commerce than merely a surface. Why should we not take a chapter from railroad transportation, trolley transportation, marine transportation and equip these highways as the traffic over them demands; in other words, after building a permanent surface roadway, complete the job by getting it ready for use, not merely in daylight hours, but during many hours of the night as the need of the times demand. Again may we repeat: Let us finish the job and realize that when we have built a fifteen foot concrete highway we have finished the job. A railroad is not completed when the roadbed is done and the track laid. The signals for day and night travel are as essential as the steel rails. Our riverways and canals are not completed when the adequate depth of channel is achieved, the signals for day and lights for night must be installed. What an intricate signal system has been developed along our coast for coastwise and hig sea travel. What a system of lights and signals has had to be established for the air service between London and Paris as well as other air routes.

In this rather extended reference to railroad, marine, and aerial lighting along their respective ways of travel, there has been no thought of diverting attention from adequate lights on all users of our roads, but rather the thought has been to survey broadly all factors entering into safety on our highways and not to be guilty of approaching the subject from a single and selfish viewpoint.

Elimination of accidents will not be achieved by attacking at one point, but rather by correlated attacks at all points where attention is needed. Connecticut has shown that where an accident a day occurred on a part of the highway, further accidents were practically eliminated by relocating a short portion of the highway and removing bordering interferences. The old location was safe for horse traffic and for years was fairly safe for motor traffic but with the present mutiplication of traffic the only solution of accidents lay in relocating the offending portion of highway.

Our cities have done excellent work by improved traffic control, by establishing safety zones for pedestrians, by an attempted control of pedestrians, by surface markings on streets, by suitable night signals, etc. This commendable work prompts us to ask the question if our State Departments having control of our highways have sufficiently realized that some of this work needed in making our cities and towns safe, should be extended to the rural highways, particularly those portions constituting main arteries with heavy travel day and part of the night. Before leaving this study of the highway let us consider briefly the subject of highway lighting. It is only in the last few years that subject has been given anything resembling serious consideration by concerns that have developed systems for city lighting. The A B C of highway lighting has yet to be written. A few stretches of highway are being lighted with experimental systems, that give promise of excellent results and our state departments must keep this subject in mind as a part of the problems of making our highways safe and constitute a part of the task of highway regulation.

The last year has witnessed rapid development in the use of signal lights at street intersections in suburban areas. No uniformity exists in the color or location of these lights. In one city of 40,000 population in the zone of Greater New York City are three different colored lights on a leading highway in the distance of two miles. All three are blinking types or intermittent lights, one showing a green light in both directions; another a green in one direction and white in another; and another red in one direction and green in another. There is no field for intermittent lights of this character on the highway because of the tax they impose on the mental energy of the driver. Asteady green light is preferable and safer. In a night trip of twenty miles north from New York City, and in other directions as well, the driver is confronted with a veritable chaos of lighting schemes, each of which demands a mental problem at a time when the driver is approaching a danger zone and when most of his mental alertness is needed in watching other users of the highway and controlling his vehicle. All highway signal lights of this character should be standardized not only as to color, but as to height and location.

Lights on the Vehicle

Coming to the consideration of the lights to be carried by all vehicles using the highway, I aim to be sanely conservative by emphasizing that the time has

(To Be Concluded)

Current Events in the Field of Highway Engineering and Transport

ROAD MATERIAL TESTS AND RESEARCH CONSIDERABLY ADVANCED DURING 1922

The activity in research and the promising results that have been obtained have been outstanding developments of the past fiscal year, says the annual report of the U. S. Bureau of Public Roads. To some extent the bureau has been associated with practically all the major investigations that have been in progress. The research carried on by the division of tests at the department experimental farm at Arlington, Va., is regarded not only as the most important function of the division, but as one of the most valuable services the bureau is performing.

Road design has until recently been almost entirely a matter of judgment and precedent. Even when the probable weight of the traffic that would follow improvement has been ascertainable, and the climatic and soil conditions have been known with a fair degree of definiteness the lack of definite knowledge of the effects of these factors upon the road has prevented the employment of such scientific methods of design as have been applied to other engineering structures. The purpose of such investigations as are now being conducted is to develop such methods of road design, and though the results thus far obtained are indicative rather than conclusive, certain fundamental principles are gradually being evolved that ultimately will form the basis of scientific methods and permit the design of more durable and economical roads. The investigations at Arlington include the measurement of motor-truck impact on highway surfaces, determination of the resistance to impact of various kinds of road surfaces, the drainage of subgrades, the characteristics of subgrade materials, the study of the warping and movement of road surfaces due to natural causes, accelerated tests of various surfacing materials to determine their resistance to the wear of traffic, and bridge investigations, including the distribution of stress in skew arches and the impact stresses set up in bridges by moving loads.

To the State Highway Department of Illinois and the Highway Commission of California, cooperating with the Columbia Steel Co. of Pittsburg, Calif., the country is indebted for two researches, conducted at Bates, Ill., and Pittsburg, Calif., on a scale never before attempted. Both of these investigations had for their purpose the testing of actual road surfaces of various designs under actual traffic. By the boldness with which these tests were conceived and the thoroughness with which they were conducted the two State departments and the steel company have made the outstanding contributions of the year to the advancement of the science of highway engineering.

The researches completed last year at Arlington and those at the Bates road in Illinois and at Pittsburg, Calif., in which the bureau cooperated, have thrown considerable light on the traffic-resisting qualities of road surfaces of different designs laid on various subgrade materials, and have led to certain tentative conclusions as to the proper thickness of slab for different weights of vehicle. Immediate results are apparent in the altered standards of design in some States, and as the information is gradually disseminated other States will no doubt follow. Results of the motor-truck impact tests are being used as the basis for the amendment of laws governing the weight of motor vehicles.

There is still need, however, for much more investigation. Information is badly needed as to the physical characteristics of subgrade materials which are causing certain roads to give short service, the proper manner of draining soils of different types or their possible treatment with admixtures of stabilizing materials, and the relative strength of bituminous surfaces on concrete bases as compared with concrete slab surfaces.

MINNESOTA GOOD ROADS PROGRAM UP TO LAWMAKERS

Legislature to Determine Whether Needed Improvements in Many Parts of State Shall Be Made

More than half of needed trunk highway improvements which may be made in the State of Minnesota during the next two years are hanging on action by the incoming legislature on the highway department recommendations for first issues of trunk highway bonds, according to John H. Mullen, assistant commissioner and chief highway engineer.

"There is no magic about road building—it simply takes money in reasonable proportion to the work undertaken," states Mr. Mullen, "and Minnesota has been fortunate in getting low prices and in other ways since the new highway program was launched, but under the most favorable conditions the highest standards of financing are of first importance.

"First state highway bonds are proposed now to permit the state to make greatly needed improvements, to stop maintenance waste, to give immediate benefits in nearer proportion to immediate expenditures and to keep pace in the general movement among states for better highways. Unless the bond funds are made available, it will be possible to do in the next two years less than half as much in the way of permanent betterments than will be done otherwise. A just policy of using funds to the best interest of the largest numbers of highways users gives precedence to the heavy traffic routes. So in reality the purpose, more than to permanently improve many heavy-traffic sections, is to release money to go on with very extensive grading and graveling work on the longer mileages of lighter traveled state highways. There is now every prospect of favorable action on the proposals and future results will establish the good business practice behind the recommendations."

Mr. Mullen said the department will continueto distribute highway betterments as widely as possible but that more adequate funds are needed to overcome the greater increase in traffic over highway improvements.

INDIANA RECLAIMS OLD BRIDGE WITH SAVING OF 20 PER CENT OVER A NEW STRUCTURE

Some idea of reclamation work going on within the Indiana state highway department as well as construction of new roads and maintenance, is gained from a recent announcement by John D. Williams, director, that it cost only $20,000 to place a new concrete pier beneath the big steel bridge across White river at Martinsville to make it as serviceable for years to come as a new structure costing $100,000.

This work was accomplished under direction of William J. Titus, chief bridge engineer of the commission, and it is remarkable by reason of the fact the bridge was jacked up on false trestle work while the new pier was made, and in this condtion went through three severe floods during 1921 and 1922.

The Martinsville bridge is on State Road No. 22, one of the chief arteries of the primary state road system running from Indianapolis through Martinsville, Bloomington, Bedford, French Lick to Evansville. It is a preferable route from Indianapolis to Memphis and Gulf cities and while it is one of the most heavily traveled roads in Indiana, traffic was not held up or rerouted at any time during several months repairs were under way.

The bridge was erected about 37 years ago and consists of three spans each 175 ft. long. The east pier at that time stood on dry land. In later years the river channel changed and now the span stands 75 ft. in the water from the shore line in low water stage. The stone work of the old pier crumbled before the force of the water, and when the state highway engineers started to repair it, they found the pier crumbling away with the heavy span ready to collapse. The stone pier rested on a timber grillage of hewed logs. The new concrete pier rests on long piling driven through the sand of the river bottom to bed rock far below the surface.

According to Mr. Titus the bridge is now in condition to withstand augmented present day traffic for many years. Even in theh ighway commission where much work at bridge reclamation goes on constantly, the saving of this structure is considered remarkable, because traffic was not interrupted and the false trestle withstood flood waters on three occasions, once when the rise was 16½ ft. The ends of the bridge have been painted white to aid in night driving.

UNITED STATES CIVIL SERVICE EXAMINATION FOR HIGHWAY ENGINEER

The United States Civil Service Commission announces the following open competitive examination:

Highway Engineer $2,400 to $3,000 a Year. To fill positions in the Bureau of Public Roads, Department of Agriculture, for duty in the field.

Competitors will not be required to report for examination at any place, but will be rated on the subjects of (1) education and preliminary training, weighted at 45%, and (2) experience and fitness, weighted at 55%.

Applications will be rated as received until March 1, 1923.

Duties will consist of superintending the construction and maintenance of roads of various types, cooperating with the state highway departments, etc.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or secretary of the Board of U. S. civil service examiners at the post office or custom house in any city.

CANADIAN MINISTER OF HIGHWAYS

Inspects Ontario Road System

The potency of the good roads movement as a promoter of interprovincial good feeling and the all-Canadian spirit reveived striking exemplification in the visit which Hon. J. L. Perron, in his dual capacity of president of the Canadian Good Roads Association and Minister of Highways for Quebec province, paid to Ontario as the guest of Hon. F. C. Biggs, Minister of Public Works, in the middle of November. The visit was a sequel to the interprovincial conference on roads held in Montreal in October, and attended by the ministers of roads and their chief officials from practically every province in the Dominion. Hon. Mr. Biggs on that occasion extended an invitation to his Quebec confrere and the other chief officers of the Good Roads Association to make a tour of inspection of Ontari's highway system, and the recipients of the invitation gladly availed themselves of the opportunity.

Accordingly after a short meeting of the executive committee of the association on Tuesday morning at Toronto, cars were provided and the party were conveyed to the opening of the new Highland Creek bridge, about fifteen miles east of Toronto, on what will soon be the through Toronto-Montreal highway.

Instead of proceeding direct to the scene of the opening, the route over which the party was taken formed a loop around the northern section of Toronto, affording the visitors a general idea of the way in which the provincial roads radiate from the city, and giving them in particular an example of the manner in which Toronto is co-operating with the provincial plans by making Bloor Street which crosses the city about two miles north of the waterfront and the main business section a broad and splendid thoroughfare designed not only to carry crosstown traffic but also through motor travel, thus permitting tourists to avoid the congested districts altogether or reach specific points downtown with the minimum of inconvenience. This plan of providing alternative routes avoiding the crowded business districts is being strongly advocated by traffic engineers and widely adopted in the more enlightened communities, and the good roads enthusiasts were delighted to learn that Toronto had set such a good example

FRED A. MARSH DIES

Fred A. Marsh, the General Purchasing Agent of the Link-Belt Company died suddenly at his home, No. 6436 Greenwood Ave., Chicago, on the evening of December 11th, 1922. Mr. Marsh was 52 years old.

He was a member of the Link-Belt organization for over 33 years; was one of the organizers of the Purchasing Agents Association of Chicago, and served ably as the first President; has been for some years a director in the National Association of Purchasing Agents; and will be remembered by his large circle of business aquaintances as a particularly well informed man in his line, of sterling character, absolutely impartial in his treatment of sellers, buying on merit, and an honor to the important business profession of Purchasing Agent.

ROAD DEVELOPMENT IN INDIANA

The rapidity of development of a state road where a relocation and surfacing with gravel was necessary, is illustrated in the work of the maintenance and bridge divisions of the Indiana state highway department which have recently finished 20 miles of State Road No. 4 between Evansville and Mt. Vernon.

The section of road, formerly a mere lane, was taken into the highway system last spring, and today it is in splendid condition with a new concrete bridge and a relocation of right-of-way of three-quarters of a mile that eliminates three sharp and exceedingly dangerous curves, one of which last fall was the scene of a fatal accident.

The relocation is about half way between Evensville and Mt. Vernon. There the old road wound and twisted through the foothills, and a steel eye-beam bridge resting aslant with the highway made traffic unusually hadardous. While maintenance crews under direction of A. H. Hinkle were widening the roadbed, easing curves, reducing grades and resurfacing the entire 20-miles with gravel dredged from the Ohio river adjacent, bridge division men under the direction of W. J. Titus, erected a modern concrete single arch 30-foot span bridge across a small stream. The old bridge was used while the modern one went up and traffic not interfered with during course of construction.

State Road No. 4 is one of the principal highways of southern Indiana and carries the volume of traffic across the state between Illinois and Ohio and out of northern Kentucky. Because of three very dangerous turns coupled with heavy traffic, the Evansville Mr. Vernon section was extremely hazardous. It was practically impossible to keep guard rails on the old bridge, because a machine of any size invariably knocked them off negotiating the turn owing to the peculiar alighnment of bridge and road. Three big trucks went off the bridge last fall, records in the highway office, show.

All materials for the bridge excepting cement and reinforcing steel was purchased from business houses in the locality. Local workmen only were employed at surfacing, using reclaimed war surplus trucks, possession of which cost Indiana only the expense incident to remodeling them for highway work.

Personal Mention

G. A. Crayton has resigned as office engineer with the South Dakota State Highway Commission and has accepted a similar position with the Illinois Division of Highways.

A. E. Drew, until recently a resident engineer employed on highway construction work by Collin County, Texas, has become identified with the Midwest Engineering Co., Silverton, Texas. His position is that of resident engineer.

W. W. Sayers, of the Link-Belt Company, has been promoted to the position of Chief Engineer of the Company's Philadelphia Works and Eastern operations. For many years Mr. Sayers has been representative of the Company in their Chicago territory, in the lines related to power house machinery, coal storage, Peck Carriers, crushers, etc., and later in charge of the Locomotive Crane Department. His headquarters will be at the Philadelphia office for the future.

OFFICIAL PROPOSALS

HIGHWAY WORK

Notice to Contractors

TRUCK SCALES

SEALED PROPOSALS will be received by the State Highway Department, at its office, Dover, Delaware, until 2 o'clock P. M., January 3, 1923, and at that time and place publicly opened for furnishing and installing a 20 ton Howe or Fairbanks Auto Truck Scale, with platform 20x9 feet, approximately one mile south of Hares Corner on the Coleman duPont Road.

Performance of contract shall commence within ten (10) days after execution of the contract and be completed on or before March 31, 1923.

Monthly payments will be made for 90 per cent of the construction completed each month.

Bidders must submit proposals upon forms provided by the Department.

Each proposal must be accompanied by a surety bond, certified check, or money to the amount of at least ten (10) per centum of the total amount of the proposal.

The envelope containing the proposal must be marked "Proposals for Track Scales."

The Contract will be awarded or rejected within twenty (20) days from the date of opening proposals.

The right is reserved to reject any or all bids.

Detailed plans may be seen and index plans and specifications may be obtained upon deposit of ten dollars ($10.00) which amount will be refunded upon return of plans and specifications in good condition at the office of

STATE HIGHWAY DEPARTMENT.
Dover, Delaware.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor

E. W. TREE, Managing Editor

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TABLE OF CONTENTS

Distributing the Cost of Construction Replacements, and Maintenance of State Highways 213
By Roy D. Chapin

Standardizing Light for Highway Vehicles 215
By David Beecroft

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Highway Practice Principles Recommended . . 217

Indiana Reports Roads in Good Condition . . 217

Joint Conference on Roadside Billboards Held . 217

University of Michigan Appoints 1922-23 Fellows in Highway Transport 217

Gordon Lee Resigns From U. S. Bureau of Foreign Commerce 218

Ingersoll-Rand Announces New Line of Air Compressors 218

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Court Street: The original "Tarvia-X" street built in 1909 and still a credit to the town.

Civic Center: An example of "Tarvia-X" construction and maintenance, originally built in 1910.

North Street: Familiar to all the pilgrims to Plymouth Rock as a Tarvia street for the last 13 years. In addition to pleasure traffic it has taken the teaming from Plymouth wharves.

Tarvia in Plymouth, Mass.

THIRTEEN years is a short period in the history of Old Plymouth. But it is a long time for inexpensive pavement to withstand the wear and tear of modern traffic, with next to no maintenance.

Mr. Arthur E. Blackmer, Superintendent of Public Works for Plymouth, writes:

"Our experience with Tarvia covers a period of consistent use for thirteen years —The town now has thirteen miles of Tarvia macadam.

"At the recent tercentenary celebration, held in the summer of 1921, over a million strangers visited this historic town, and Tarvia again proved its worth by satisfactorily protecting the roads even though subjected to the consequent unusual traffic."

Plymouth has found through long experience that Tarvia construction insures maximum mileage of well-paved streets—that its moderate first cost permits a more extensive paving program, and its economical maintenance materially reduces the annual upkeep expense.

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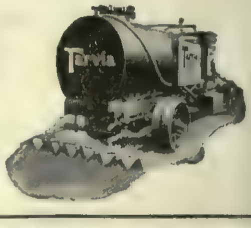

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE
WITH WHICH IS INCORPORATED
THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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Distributing the Cost of Construction, Replacements and Maintenance of State Highways

By ROY D. CHAPIN

Vice-President, National Automobile Chamber of Commerce, Inc.

LIVING in an age when we have at our call all of the comforts and conveniences which modern science has made possible, it is perhaps well that we should pause occasionally to analyze those human needs and desires, the satisfaction of which have impelled us forward to our present stage of civilization. It is desirable that we do this, not so much because we seek a yardstick for the measure of our past advancement, but because in our plans for the future we must be sure that we do not depart from fundamental instincts of humanity. Progress which does not help to fulfill these instincts is but temporary. Life itself is too short for wasted effort when so much that is worth while remains to be done.

If we could trace back to the earliest demand of mankind, we should probably find that it was a request for something to eat. The next demand was that for shelter, then for clothing. The family followed, and the social structure of today rests on these four cornerstones. Civilization is nothing more than a charter of rights to the enjoyment of these primal instincts. It is our task then to do what we may to insure these rights to all.

Highway Transport Means To End

Few means afford a larger field for this advancement than does transportation, and more particularly highway transport, the one universal, developed opportunity for **individual** transportation. Through its application we can glimpse the possibility of equalized opportunity for farmer and city dweller for the highest form of family life, and aside from the actual progression of the science of life itself, there is perhaps no single other agency which holds as great promise for the future as this does.

If we but stop to consider the quiet but none the less far-reaching changes which the motor vehicle has already made in our social life, we will find immediately ample justification for every effort which we may make to bring this new form of transport to the highest possible degree of service. The motor vehicle satisfies an inherent human desire. It gives a new expression to family life, and more broadly, it offers mankind a new and convenient means of communication for the purposes of barter and exchange, community gatherings, emergency medical service, recreation and all the thousand and one ramifications of a human desire made accessible through modern civilization.

Sound Premises For Highway Development

We can be assured, then, that the premises upon which we are laying the foundation for vast highway systems are intrinsically sound. This need is not a temporary one and we are justified in large expenditures, so long as we can be assured that the policies which we lay down for the control of those expenditures are wisely shaped.

The task which confronts us, then, is one that requires the wisdom of the statesman, the vision of the social economist, the acumen of the financier and the efficiency of the engineer. At the outset it places a heavy burden upon all responsible authorities, with a sure compensation ahead for those who proceed with the needs of all in mind, and with just as sure a reaction against those who give heed to special as opposed to the general welfare.

In any analysis which I have made of the subject of highway finance, I have been impressed with the fact that what we are concerning ourselves with is fundamentally a business proposal. After all we are not dealing merely with the building of roads. We are dealing instead with the production of transportation, which is just as much of a manufacturing process as is the building of the motor vehicle itself. Accordingly, the business analogy presents itself as a sound rule for highway policies, since in its adoption we return to principles which have been tested and found practical over a long period of years. The first item then is to analyze the need. This we have done. Next we must determine just what roads are essential to earn the income which shall justify our expenditure, how rapidly these roads shall be built, which ones shall take precedence.

Knowing these factors which can only be surely determined by careful and accurate surveys, not alone of traffic but of economic possibilities, we must then pro-

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Abstract of a paper presented at a joint session of the North Central Division of the National Highway Traffic Association and the Michigan State Goods Roatds Association held at Grand Rapids, Michigan, November 21, 1922.

ceed to analyze our financial resources, determine our possible income and then proceed to select that type of administration which will build our highways most carefully and most economically, with due regard for the purposes for which they are intended.

The first question, then, which confronts us is a determination of the present stage of development of this manufacturing plant which we are taking over. If it is a going concern with ample facilities in the shape of already improved highways, then we will probably find that we can draw sufficient revenue to meet our requirements from current operating income. We may need a short term bond issue here or there, to take care of a special extension such as a widened road or improvement from an inferior to a superior type of pavement, but in the main we can pay-as-you-go. Of all the states in the Union, Maryland is perhaps the best example of this kind which we have and one of the very few, since Maryland has already improved most of its main system through long term bonds and is now concerned chiefly with the maintenance of these highways to meet the traffic requirements.

If we are discussing a state such as Michigan, however, we will find a somewhat different situation. A fifty million dollar state bond issue, coupled with county and federal funds, will complete all of the state system except the 400 miles added by the last legislature. That completion, however, does not include improvements of a number of gravel roads which must be raised to a higher type because of increased business or traffic, and consequently, the situation may present the need for new manufacturing facilities or roads which may require a supplementary bond issue, the extent of which will depend upon the actual growth of traffic in the interim.

Virginia Example of New Territory

Then we turn to a state such as Virginia, only now upon the threshold of a venture in the production of transportation. Here the plant is in such shape that if we hope to care for the business which is awaiting us now, we must immediately turn to a bond issue as the means of raising the initial capital outlay, as otherwise the drain on our current income would be so great that while we might be able to construct our roads, we could not maintain them. And it is just as absurd to build roads and not maintain them as it would be to build a factory and allow it to go to pieces.

Beyond that, however, we have accepted theories in business finance which apply definitely to the case at hand. No large business organization today, or few small ones, will attempt to finance capital expenditure out of current income. The reasons are obvious. If, for example, a manufacturer should say, "I need a new factory. It will cost me $50,000 and will produce 10,000 tires." He could not then say, "I will distribute that cost $5.00 per tire over my next year's output." Business competition would not permit such practice, but he could distribute that cost over a period equivalent to the length of life of the factory, and then assess each consumer accordingly.

The question which then arises is, "What is the life of this factory?" You will hear men say that our roads are going to pieces and that the analogy between business and engineering practice breaks down at this point. It this question arose in a business plant, the executive would call in his research men and put the question to them. Suppose we call upon the research men of the U. S. Bureau of Public Roads, or, taking a short cut, turn directly to the report of the chief of the bureau, T. H. MacDonald.

"Much that we have known about highways is not so," we read, and summarizing an official viewpoint, we find that a close survey made by the Bureau shows that 40 per cent of all of the Federal Aid projects costs has gone into permanent features of the highway such as location, drainage, gradients, curvatures, shoulders and engineering costs. Of the remaining 60 per cent allotted to surface costs, we find that when the time for reconstruction of the highway comes all but a percentage equivalent to the cost of interest and sinking fund is salvaged as bedding for the new surface.

In a word, we find that we have been led into the fallacious belief that to lose the surface has been to lose all.

Lack of Maintenance Funds Costly

But this is not all. The executive searching for still further supporting data finds that in many cases the actual reason for surface deterioration has been a lack of adequate maintenance, an overloading of equipment in times of seasonal strain. Expert opinion tells him that the engineer can build the road to handle the traffic and that all that is required is absolute maintenance.

The judgment then is that we are justified in distributing our capital costs, provided we require maintenance, and we can proceed knowing that what we are doing is to provide as exceptionally as possible a network of highways which we shall have the use of in **our** life-time and which we shall pass on to our children for their use in turn, each generation paying a fair rental charge in the form of maintenance costs plus amortization costs.

Will it cost us more to follow this plan than to pay the charge from current operating expense? Yes. Are we justified? Yes. How? By these two facts, either of which is sufficient. First, we are supplying a universal human need,—adequate transportation for all. Second, the increased use of the highways by the public in our own lifetime will more than offset the amortization charges, even if we could deny the increased valuations which will accrue to urban and rural properties, which we cannot. Moreover, if we built from current funds, we should have an average of only 50 per cent of the use of a given mileage in, say, a 10-year program, while by paying as we use, we shall have practically a 100 per cent usage. Yet the difference in cost is only found in the amortization charge.

We shall not make these statements, however, without imposing certain rigorous limitations. One, that of maintenance funds, has been mentioned and it cannot be stressed too emphatically. Further, state bond issues should not be sought for roads of purely local use. Generally speaking, these will carry only a light traffic and maintenance cost will suffice. State issues should be concentrated on those highways which traffic and economic surveys show are of first importance from the state point of view. If this system is carefully laid out, it will be found that there are few points more than 15 miles from a main road and the policy of financing these feeders will depend upon the character and extent of the traffic.

Again, the administration is an important element. The leaders must be men of vision who will deal with this problem as with any major issue of public welfare. Control should be centralized in their hands as the local man cannot be expected to, nor should he, consider

(Continued on page 216)

Standardizing Lights for Highway Vehicles

By DAVID BEECROFT

Vice-President, North Atlantic Division, National Highway Traffic Association.

(Continued from December 20 Issue)

arrived when vehicles of all characters must be equipped with a lighting system, standardized so far as color and position of lights are concerned. We cannot temporize longer with the horse vehicle that is a double danger, first to itself and second to the other users of the highway. We cannot temporize further with the motor truck that hangs a lantern with a red glass from the center of the body at the rear. We cannot temporize further with the reaction engine pulling a threshing machine and water wagon with not a rear signal light, and too frequently a single lantern with white glass on the front. We cannot temporize further with the motor car that offends with its dazzling headlights. Our highways at night are no longer used for a few miles by residents along the route, but nightly our interstate roadways are used by vehicles whose owners may reside in the adjoining state or several states beyond. Nightly these highways are used by those who are often strangers to them, not infrequently by many who may not use them again for years. This character of travel makes it correspondingly more important that all users observe the lighting laws. In wriitng regulations governing lights, there must be no favoritism for any particular type of vehicle, all must be considered as users of the highway and equall ysubject to regulations governing their use.

Considering the specific lights used perhaps no one light has been more widely discussed during the past year than that of the color of the tail light. About one year ago a movement was started backed partly by railroad interests to have the use of the red tail light on motor vehicles discontinued and a yellow light substituted. The reasons advanced were that where roadways paralleled railroad lines locomotive engineers were at times confused in their signals. Fortunately, we feel certain, there has been a change of heart and now the railroads are resigned to the use of the red tail light on motor vehicles and everybody else from scientists down, are of the opinion that no better rear signal exists than the red lights. Its future use is undoubtedly assured. It should be the universal light for the rear of all highway vehicles, motor propelled, horse drawn or propelled by persons. Such a standardization of its use will simplify night driving, will conserve the mental energy of the operators of all types of vehicles and should be conducive to better physical control of vehicles with a corresponding lowering of accidents.

Granting that the red tail light is to be the permanent light its location is yet open to debate and also the capacity of the light to adequately illumine the state registration numerals. The Commonwealth of Massachusetts has recently attacked this problem with vigor and the new law requires the lamp portion to be above the middle of the license bracket and to throw a white light over the face of the numerals. This light must be thrown through a glass portion of the lamp and not through mica or celluloid window. No objection can be urged against what Massachusetts has done. She is merely carrying out the intent of the original law in many states covering the illumination of lighting bracket. The new law is a just one.

The location of the tail light is far from being a settled question, particularly on motor trucks, threshing machines, trailers, etc. The extreme left rear of the body is considered generally the most useful location in that it designates the extreme edge of the body and so serves as a valuable guide to overtaking vehicles that must pass on the left. This location should avoid those accidents due to no indication of the body width when the light is under the center of the chassis. Carrying a swinging lantern with a red glass under the middle of the rear end of a vehicle is not sufficient. A red light at the extreme left should be carried on all types of horse vehicles, motor vehicles, trailers and machinery in tow such as threshing machines, etc. There is no necessity for two red lights on the rear of any vehicle. It has been suggested that on large trucks there should be one at each side of the body, some states going so far as to suggest a red light at one side and a green light at the other. Two lights merely double the number the drivers in following vehicles have to see. **They will confuse rather than clarify.** Our lighting of vehicles and roadways must be simplified to the final syllable and it is the golden rule of vehicular lighting not to use two lights where the job can be done better with one. This may be opposed to the business adage of making two blades of grass grow where one grew formerly, but the case is different. Let the rule be to let one suffice if it does the job. Further there should be no necessity for specially large tail lights on motor trucks, a standard size will suffice if properly located and with an adequate electric bulb to illuminate.

Still another thought with regard to the tail light; If it is to be placed on the extreme left rear of the body it can play the dual role of showing a red light to the rear and a white light ahead, thus indicating the approaching vehicle, the width of the vehicle body.

This brings us to the question of the use of a light showing forward that will indicate to approaching vehicles that the vehicle is a motor truck as well as indicating the extreme left of the vehicle. You will recall that the use of such a light is much disputed by the motor vehicle commissioners in different states. The author of this paper is open-minded as to the use of such a light, but has definite opinions concerning its color. Only a white light should be used. A green light has been suggested, but it will add to the confusion of drivers of approaching vehicles, particularly at the present when green lights are used on highways for so many other purposes.

Professor Blanchard has suggested a white light located centrally above the dash on cab to designate the character of the vehicle approaching.

The alphabet of color is red for danger-stop. White stands for forward illumination and signals. These are enough for the vehicle. But the universal alphabet of green be for caution, and its use confined to the role of highway signals.

Distributing the Cost of Construction, Replacements, etc.

(Continued from page 214)

state needs first. Any departure from such a program as this is likely to result in disconnected highways and the question of maintenance becomes a highly uncertain equation.

The question of traffic regulation is another where only the state official can act with due regard for the economic needs of the community. We have indicated that overloading of the plant has been a partial cause for its breakdown in the past. Power should be lodged with the state authority so that he can prohibit overloading the vehicle in normal times and can make such restrictions as to loads as will safeguard the general welfare at seasonal periods. By the same act, the commissioner should have power to permit overloading in emergency. The only purpose for road construction is to serve traffic and situations such as the present railroad congestion may make it cheaper at times to break down an inadequate highway surface than to permit unemployment, hunger or cold to come to a community.

This brings us logically to a discussion of what kinds of highways we shall construct. The answer is found solely in economics. That type of highway should be constructed which will care not only for the present but for the future needs of traffic. No highway improvement is justified if it does not satisfy a human need or unless the cost of improvement is more than cared for in the saving effected to the public through better and cheaper service. The problem is so large, the needs so many and diversified, that over-development is just as serious an economic error as under-development.

Construction and Maintenance Defined

How are we going to pay for this improvement? In a general way we have said that original construction is a matter of capital outlay; so also is any extension or any replacement of an inferior by a superior type of pavement to the extent of the difference in cost. The analogy is that of a new factory building or the replacement of old machinery by improved units. Maintenance then becomes all of the remaining charges or in effect the constant making of needed repairs up to and including reconstruction, in order that the plant may give service at all times.

At this point we are faced squarely by the need for saying from what sources we are to draw our income in order that our finances shall be equitably levied so that the public may buy its transportation at the lowest possible cost. The answer will vary in detail according to the stage of development of the system or plant with which we are dealing. It will vary according to population, square miles of area, mileage of roads under consideration. But still we have before us definite principles based upon studies of fact which well may be taken as sign posts.

It is a safe principle to say that those who benefit from the highway shall pay for its construction and maintenance. Who is it that benefits? Definite economic surveys made by the U. S. Bureau of Public Roads show that in the initial improvement of the highway there is found an accretion in the value of land in the vicinity which ranges anywhere from 300 to 1,000 per cent. More important, there is the fulfillment of a human need which, while it may not be directly susceptible to economic treatment, is nonetheless a large factor in road construction, particularly in the agricultural regions.

Urban Valuations Increased

Urban valuations are also increased by the construction of rural highways, because not only does the highway bring new buying power to the city but it also brings about a tremendous suburban development which is, as yet, only in its infancy. Finally, the man who uses the highway finds his costs lessened as it is improved, or better, as it is maintained in a constant condition of service.

Taken in sum, these three elements represent all of the taxpaying elements of the community; hence it may be fairly said that capital charges for highway construction should be provided for from general taxation whether these payments are made in the form of amortization charges for a long term bond issue, which spreads the charge over this and succeeding generations of beneficiaries, or whether it be a special levy.

When we come to the question of maintenance, however, the problem is not as clear, as we have not had sufficient research to determine accurately all of the secondary influences of improvements upon valuations. We do know, however, that the user of the highway is one who obtains the first service from it, that his costs are affected as the highway is kept in condition or allowed to go to pieces, and finally, that much of its depreciation is due to use.

It thus appears that the user should be charged with the upkeep of the road, a principle which is sound from a financial standpoint in that our present system of motor registration is a recurrent annual charge which automatically produces the revenue necessary to maintenance. For this reason it is fair to insist that motor fees should be set aside for maintenance rather than diverted into construction, and further, it is reasonable to demand that the administration of these funds shall be so controlled as to make the highway of the utmost service.

Principles Suggested for Adoption

In conclusion, then, I should say that we cannot solve the highway finances of a country so diversified as this by any detailed formula but we can proceed to adopt certain definite principles which may be expressed somewhat in this way.

1. Highway systems should be laid out by state highway departments, with a definite view to meet the social and economic needs of the commonwealth.
2. The needed revenue for construction should be secured from long term bond issues based upon general taxation, while current operating expenses should be secured from the user and should be adequate to maintain the highway once constructed.
3. Centralized administrative control is essential to a proper development of these systems as well as to the regulation of their use, and broad powers should be granted the state department in charge, to insure an economic flow of traffic.

It is hardly necessary to emphasize, in closing, that the need for general bond issues will be dependent upon the degree of present improvement of the system. The problem which confronts us is one of satisfying a proven human need, the elemental desire for individual transportation, the fulfillment of which is a social as well as an economic necessity to our further progress. The more rapidly our finances can be placed upon such a basis as this, the more rapidly will the states, as a whole, afford new opportunity for those who, living in city or country, have found themselves deprived of opportunity for free communication which should be the right of all.

Current Events in the Field of Highway Engineering and Transport

HIGHWAY PRACTICE PRINCIPLES RECOMMENDED

Adoption Would Eliminate Unnecessary Difficulties and Result in Economy

As a result of the consideration of the means of stabilizing the road building industry and reducing construction costs at the successful joint meeting of contractors and state highway engineers in Kansas City, December 4-5, a report recommending certain principles of administration and practice was drawn up and approved by the convention of the American Association of State highway officials.

At the several sessions problems confronting both the state highway department and construction companies were frankly discussed, and various difficulties encountered were analyzed.

It was pointed out that it has been the experience that some modifications of usual contracting practice are conducive to more satisfactory relations and to keener competitive bidding by responsible companies. It was emphasized that because of the great development in the highway industry the elimination of unnecessary difficulties is essential.

The recommendations, which will be presented in detail to the A. G. C. Convention in Los Angeles, cover contract surety, bidder's bond, payments, acceptance of work, maintenance, classification, adjustment of compensation, overhaul, retained percentage, force account work, stock piling, arbitration, administration, day labor construction and legislation.

INDIANA REPORTS ROADS IN GOOD CONDITION

Stone and gravel roads in Indiana are in the best condition they have ever been, thus demonstrating the value of systematic maintenance, says a recent bulletin issued by John D. Williams, director of the state highway commission.

Mr. Williams states that reports reaching his office from the various district engineers and superintendents show that the recent snow contained just sufficient moisture so that when it melted it made the roads respond to dragging. Prior to freezing a few days ago, nearly the entire mileage of secondary roads was dragged and all rough surfaces smoothed. With the thaw, roads were again dragged and now are level, smooth and in as perfect condition as it is possible to make highways of these types.

The state road system comprises about 150 miles of earth roads with the greater portion thereof under construction of resurfacing. The highway commission is exerting all speed possible, Mr. Williams says, to resurface this mileage with either stone or gravel and have no earth types in the system. There are approximately 2800 miles of secondary types such as stone and gravel, which includes the 150 miles of earth roads, in the state highway system.

With the purchase of several snow plows in order to combat probable heavy snow falls, particularly in the northern part of Indiana, the highway department is prepared to keep all main market highways open to traffic this winter regardless of the severity of weather.

JOINT CONFERENCE ON ROADSIDE BILLBOARDS AND SIGN POSTS HELD BY AMERICAN AUTOMOBILE AND POSTER ADVERTISING ASSOCIATIONS

Committees from the American Automobile Association and the Poster Advertising Association of the United States and Canada will formulate plans to combat dangerous and objectionable roadside billboards and sign posts according to plans made at a recent meeting of the A. A. A. Executive Board at Cincinnati. A committee from the Poster Advertising Association consisting of J. H. Brinkmyer President; Allen E. Frost, national counsellor, and W. J. Ferris, appeared before the American Automobile Association Executive Board and explained their position in regard to outdoor advertising.

Officials of the American Automobile Association explained to the Poster Advertising representatives that while the American Automobile Association is opposed to any form of advertising which mars the landscape that its particular opposition is to the large boards placed at intersecting highways or on sharp curves which obscure from the view of the motorist traffic coming down that intersecting highway or around that curve; to advertising signs which simulate the appearance of railroad crossing or other danger signals, distracting the attention of the motorist with the possibility of an accident; and the promiscuous use of cloth, tin and cardboard signs tacked on trees and fences which give the motorist the impression of driving along a city dump instead of in the open country.

Mr. Frost said that his association would gladly cooperate in any manner for the elimination of such signs and that his association would appoint a committee of three to cooperate with a similar committee from the American Automobile Association with a view to seeking some means for the elimination of such signs.

The American Automobile Association Executive Board authorized President Diehl to name such a committee and a meeting will be held in the near future to discuss ways and means of eliminating dangerous and unsightly road signs.

UNIVERSITY OF MICHIGAN APPOINTS 1922-23 FELLOWS IN ENGINEERING AND HIGHWAY TRANSPORT

At recent meeting of the Board of Regents of the University of Michigan the following 1922-1923 fellows in highway engineering and highway transport were appointed:

Roy D. Chapin, Fellow in Highway Transport; Major Mark L. Ireland, Highway Transport Corps, Quartermaster Corps, U. S. A.; 1901, B. S. and 1913, M. E., Michigan Agricultural College; 1921, M. S., Massachusetts Institute of Technology; 1901-1904, engineering work with New York Central Railroad and Civil Service with War Department; 1904 to date, Army Officer, U. S. A., including position of Commanding Officer, Fort Sam Houston, 1917-1918 in charge of eighty-five officers and 3,250 men, motor transport service in France and 1920-1922 U. S. War Department representative on the National Research Council stationed at Boston, Massachusetts.

Roy D. Chapin, Fellow in Highway Engineering: William J. Groves: 1920, B. S., University of Missouri (Entered School of Arts and Sciences, University of Missouri, 1914-15, School of Engineering 1915-1918, U. S. Army, June, 1918, to June, 1919, School of Engineering, University of Missouri, 1919-1920); 1920 to date, engineering work, at present Assistant County Engineer, Fayette County, Texas.

Detroit Edison Fellow in Highway Engineering: A. T. Bragonier: 1909 Graduate of Norman Department, Shepherd College; 1916, B. S. C. E., West Virginia University; 1912 to date, engaged in railroad and highway engineering; at present Instructor in Highway Engineering, West Virginia University and engineer, West Virginia State Highway Department.

Detroit Edison Fellow in Highway Engineering: John D. Slye: 1914, B. S. C. E., University of Colorado; July, 1914, to May, 1917, engineering work with Santa Fe Railroad and Chicago, Burlington and Quincy Railroad; May, 1917, to September, 1918, Construction Engineer with Witherspoon-Englar Construction Company; September, 1918, to March, 1919, Engineer, Officers' Training Camp, Camp Humphreys, Virginia; April, 1919, to date, Chief of Road Survey, United States Bureau of Public Roads, Headquarters 301 Custom House, Denver, Colorado.

PORTLAND CEMENT OUTPUT IN OCTOBER

Figures just released by the U. S. Geological Survey for the month of October, show a continued heavy consumption of cement, with constantly diminishing stock on hand—the smallest amount for some time past.

During the month 12,287,000 barrels were produced, as compared with 11,424,000 during September, and 10,506,000 during October, 1921. This was the sixth record breaking month, with an increase of 7½ per cent. over the September figures.

Shipments of cement during the month amounted to 12,854,000 barrels. This was an increase of 410,000 barrels over the September figures. It also shows 567,000 barrels beyond the production for the month. Compared to a year ago, there were 740,000 more barrels shipped in spite of priority orders.

At the end of October 4,157,000 barrels were on hand, which represents about one-third of a month's production.

GORDON LEE RESIGNS FROM GOVERNMENT SERVICE

Inability of the Government to compete with private industries in the matter of salary has cost Secretary Hoover of the Department of Commerce one of his most valuable and active assistants, Gordon Lee, Chief of the Automotive Division of the Bureau of Foreign Commerce, who has resigned to take up the work of directing foreign sales of the Yellow Cab Manufacturing Company of Chicago, Ill., assuming those duties the first of the coming year.

Mr. Lee came to the Department of Commerce for the specific purpose of organizing the Automotive Division more than a year ago, having been selected by the National Automobile Chamber of Commerce to develop the foreign activities of the automotive industry. Having firmly established his Division to the satisfaction of the industry Mr. Lee feels that he will not be doing the Government or the automotive industry an injustice by resuming his place in industrial life. Upon tendering his resignation Mr. Lee pointed out that the field of automotive exports has reached such proportions that it is rapidly becoming one of the country's most important fields of endeavor.

"I am taking up this new work," he said, "because I firmly believe that the greatest developments in the future in the automotive industry will come in the field of the movement of goods and passengers by automotive transport in the form of taxicabs, street-busses, and intercity types of freight and passenger-carrying vehicles, and in many instances as allies of the railroads and street railway companies. Automotive transportation is an international institution necessary to modern civilization just as the steamboat, the locomotive, and the telegraph were the vehicles that brought about the world upbuilding of the nineteenth century following the devastation wrought by the long Napoleonic conflicts, and so will automotive transportation guide the twentieth century and speed up the economic development now following the World war. To the automotive industry of America has fallen the leadership and the direction of this world-wide need of transportation, thus placing upon us an obligation of education and service for transcending the continental limits of the United States."

Mr. Lee, has been associated with the automotive industry since the earliest days, having been a member of the family of Mr. George B. Selden, inventor of the automobile. Aside from an extensive domestic experience in the manufacture, distribution and sale of motor cars, trucks, farm tractors, he has spent considerable time in over-seas markets as automotive trade analyst in Europe and the Far East.

A NEW ALL-STEEL SCRAPER

The Root Spring Scraper Co. of Kalamazoo, Mich., announce a new Root All-Steel Road Maintenance Scraper. Built of special materials that insure greatest strength and longevity of life against hard wear, and reinforced wherever extra strain develops when in operation the road maintenance engineer will find more than ordinary service in this new model.

Details of construction of the new scraper include a 10-in. 105 carbon steel blade that requires no cutting bar and which projects 2 in. below springs and can be turned over, thus giving 4 in. of cutting surface. A main shaft 2/3 heavier than used on old models which means a much more rigid hold on springs and blade when cutting in hard soil. Springs ½ heavier than old model and made of high carbon steel and tempered for maximum strain. 3/16-in. wrapper springs placed over these give double strength when subjected to hard cutting. Hangers, ratchet and dog are made of malleable iron of a quality that will stand all tests to which they are put.

INGERSOLL-RAND ANNOUNCES NEW LINE OF SMALL VERTICAL BELT DRIVEN AIR COMPRESSORS

The Ingersoll-Rand Company, 11 Broadway, New York, announces a new line of small vertical belt driven air compressors known as Type Fifteen. In addition to the plain belt drive design each size is built as a self-contained electric motor outfit, driven through pinion and internal gears, or by employing the short belt drive arrangement. The compressing end and electric motor of both gear and short belt drive units are furnished mounted on a common sub-base, so that they are in no way dependent upon the foundation for correct alignment.

Several noteworthy features of construction have been incorporated, of which the "Constant-Level" Lubrication System is the most important. Others include the Constant Speed Unloader for plain belt drive machines; the Centrifugal Unloader for start and stop control machines; and the increased size of the water reservoir cooling pot.

As with the ordinary splash system, the base of the compressor forms an oil reservoir for the "Constant-Level" System. However, with this system, pet cocks determine the maximum and minimum amount of oil in the reservoir. Above this reservoir and directly underneath the connecting rod is a constant-level pan. Oil is pumped from the reservoir into this constant-level pan through a unique oil pump. Regardless of the amount of oil in the reservoir, so long as it is somewhere between the high and low level pet cocks, this system will function perfectly, insuring a constant-level of oil in the pan. A projecting stem on the connecting rod dips into this pan and distributes just a sufficient quantity of oil for proper lubrication.

The Constant Speed Unloader controls the unloading of the compressor by automatically opening the inlet valve when the receiver pressure rises above that at which the unloader is set to operate. When the receiver pressure has fallen a predetermined amount, the unloader automatically releases the inlet valve and allows the compressor to return to work and thus build up the receiver pressure again.

The Centrifugal Unloader allows the compressor to start under "no load" such as is essential when automatic start and stop control is used, and permits the electric driving motor to come up to full speed before the load is thrown on automatically. This unloader accomplishes its purpose by holding the inlet valve open until the motor has reached full speed.

The smallest size is built with either ribbed cylinder for air cooling, where the service is intermittent, or a water jacketed cylinder of the reservoir type for constant service. All other sizes are only built with the water jacket of the reservoir type. The size of these reservoir pots is very generous, and one filling will be found sufficient for long periods of operation.

A descriptive bulletin has been issued on these compressors which describes in detail all their features including others not mentioned above. Copy can be secured by writing the above address.

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HIGHWAY WORK

Notice to Contractors

TRUCK SCALES

SEALED PROPOSALS will be received by the State Highway Department, at its office, Dover, Delaware, until 2 o'clock P. M., January 3, 1923, and at that time and place publicly opened for furnishing and installing a 20 ton Howe or Fairbanks Auto Truck Scale, with platform 20x9 feet, approximately one mile south of Hares Corner on the Coleman duPont Road.

Performance of contract shall commence within ten (10) days after execution of the contract and be completed on or before March 31, 1923.

Monthly payments will be made for 90 per cent of the construction completed each month.

Bidders must submit proposals upon forms provided by the Department.

Each proposal must be accompanied by a surety bond, certified check, or money to the amount of at least ten (10) per centum of the total amount of the proposal.

The envelope containing the proposal must be marked "Proposals for Track Scales."

The Contract will be awarded or rejected within twenty (20) days from the date of opening proposals.

The right is reserved to reject any or all bids.

Detailed plans may be seen and index plans and specifications may be obtained upon deposit of ten dollars ($10.00) which amount will be refunded upon return of plans and specifications in good condition at the office of

STATE HIGHWAY DEPARTMENT,
Dover, Delaware.

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CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor

E. W. TREE, Managing Editor

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TABLE OF CONTENTS

The Functioning of Federal Aid in the Development of Highway Transportation 1

By Thomas H. MacDonald

Highways and the Tax Payer 3

By A. J. Brosseau

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Conference on Highway Engineering to be Held at University of Michigan 6

Nevada to Improve Lincoln Highway Along Lake Tahoe 6

Missouri Has Winter Meeting of Road Contracts . 6

4200 Miles of Concrete Paving Put Down During 1922 6

Indiana State Highway Commission Adds 16 Miles to Road 31 6

$8,000,000 Spent in 1922 on Lincoln Highway . . 6

Canada Builds 5700 Miles of Good Roads in 1922 . 7

Minnesota Road Funds Less Than Those in Many Other States Report Indicates 7

EQUIPMENT—TRADE—MATERIALS

Northwest Engineering Co. Produces Shovel With a Single Motor 7

Warren Brothers Company to Move Its Northwestern Branch Office 7

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The Journal of Highway Engineering and Transportation

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIV JANUARY 3, 1923 No. 1

The Functioning of Federal Aid in the Development of Highway Transportation

By THOMAS H. MacDONALD

Chief U. S. Bureau of Public Roads

TRANSPORTATION is, perhaps, the most vital factor in the lives of all of us. How much attention has it been given in the text-book, and in class room work? How does the educator define transportation?

Does he think of it as it was twenty years ago when the railroad was the only carrier, or in terms of the highly complex relationships of today when we have highway, water-way, electric and steam rail lines, and very soon airways to be correlated?

Is he dealing with it as it will be in the future when these agencies may overturn all of our accepted theories of economics, social life and political boundaries?

Has he taken into account the fact that highway transport has already injected new factors into our economics?

Does he understand the relation between the highway and the vehicle and the important service they render to the public?

Does he know that the highway and the vehicle together constitute a great factory which produces the commodity we call transportation?

Does he realize the importance of these factors in the financial scheme of things and is he prepared to assist in developing sound theories not alone of finance but of the actual physical structure of road and vehicle?

Does he know that transportation is today the most important problem confronting the nation, and, if we are to arrive at sound conclusions, one that requires the best efforts of the most efficient research men obtainable?

Has it ever occurred to him that the highways are not built for the individual owners, but for the public, and that the privately owned vehicles operating over the roads are in reality mere agencies for the convenience and comfort of this same public?

A Major Phase of Public Service

I ask these questions because before we can approach the problems of highway finance with the enormous sums involved, it is essential for us to understand that we are dealing with a major phase of public service.

If highway transport had not become a vital element in serving the public, if the public realizing its cost did not still demand it because of the benefits which it brings, then the educator would not be justified in considering this question. Is not the task of the immediate future, then, that of laying out broad policies which will make highway transport of the greatest benefit to all?

The first step, as I see it, is a readjustment of our financial policies which will permit the counties and the states to carry on their program of highway construction and maintenance in the most equitable manner possible. A survey of highway development as it is today shows that we are annually appropriating sums aggregating more than $1,000,000,000 for city and rural highway construction and maintenance. A further survey of our needs shows that this program must be continued for ten years or more if we are to arrive at a connected system of highways which will render the greatest possible service to the public.

We must weigh well all of the elements entering into any appropriation for any purpose and only those must be made which we know will surely return a direct profit to the public. Further we must seek to definitely allocate those profits so that the burden will be borne in as large a measure as possible by those who are beneficiaries.

Who Benefits From Highway Improvement?

In any attempt to answer this, and the many other questions ahead of us, there remains still much research work to be done. Now, therefore, the purpose must be to sketch out the paths which are indicated by governmental studies up to the present time, in order that the issues may be clarified.

Broadly speaking, we will all agree that those who are alive today and those who come after them down to the children of the third and fourth generation, will benefit from highway construction, provided that, once constructed, the highway is maintained.

Some might go further and say that the highway, if maintained, will be of benefit for all time, but looking at this as practical men, we can concern ourselves only with a definite period of time wherein the inventive genius of the country would not have opportunity to upset our present scheme of transportation by new methods. This might well be from fifty to one hundred years.

It would then appear as a general proposition, assuming the ability of our engineers to maintain a highway once built, that the cost of highway construction should first of all be divided between this generation and those to come, which, of course, at once implies long term highway bond issues. Here again, however, we come at once to practical limitations, the extent of which implies long term highway bond issues. Here again, however, we come at once to practical limitations, the extent of which must be finally determined by economic research. Can the highway engineer maintain the road once built?

We have been accustomed to hear that roads have broken down under heavy motor traffic and that money expended for them has been wasted. Is this true? Fortunately, in this field we appear to be arriving at a definite demonstration of facts. Engineers tell us, for example, that 40 to 50 per cent. of the cost of construction of a highway is a permanent investment, assuming that the highway has been properly located. The right of way, the grade, the drainage, bridges, shoulders and engineering costs need only be paid for once. It is the surface which wears.

Constant Maintenance Essential

This leaves us with a definite need for constant maintenance and that maintenance is limited not by physical but by financial ability. We have placed too much stress upon the original construction and not enough upon the constant maintenance. Can we assume proper location of the highway? Here again is a field for the student of political administration in its relation to economics. The state engineer looking at a map which shows the economic development of a state, the routes of through travel, and the feeder lines, has before him a bird's-eye picture which enables him to determine positively and accurately where highways should go. We cannot expect the local official to be able to gage this so well. Centralization of authority seems essential if the public's funds are to be properly conserved.

Should we seek to develop all highway construction through bond issue? This question is one which cannot be fully answered until those preceding it are taken into account. Before we expend any funds we must know that the benefits to be derived from the improvements of a highway are more than sufficient to justify the cost of that improvement. We must then be sure when bond issues are proposed that the improvement promises something more than the cost of maintenance.

Before granting the authority to issue bonds, provision must be made for the proper control of construction expenditures, adequate maintenance and sinking funds. These points checked off, we are likely to find that we have come down to a consideration of the improvement of the main state systems, which will average about 7 per cent. of the total mlieage of this country. When completed, this system will place all of us on main roads, or but a few miles away and through the feeder lines we will be enabled to reach the great highway and deliver our commodities to market.

Here then is the field in which the cost of highway construction should be divided between this generation and those to come. We are proposing that this generation shall undertake to build these roads, charge the cost to capital account, pay for them by long term bonds, use them and pass them on to the next generation in as good or better condition than we built them. We propose that each generation shall pay a fair rental charge for the use of these roads in the sum of amortization charges, and interest, plus maintenance.

Shall we not then proceed as would a business man, or a farmer, when setting up his establishment? The full cost of the factory or the farm would not be assessed against the first year's income, but would be carried over a term of years, during which time the returns would be enough to meet all charges and pay a profit as well.

Universal Bonding Not Always Necessary

This must not be taken to mean, however, that we should at once proceed arbitrarily to say to every state, you must have a bond issue to take care of your road improvement program. As in all other phases of this complex problem there are a host of limitations to be set up, and it is only through investigations by trained men that we shall ultimately find the correct answer.

Analyses of highway development to date show that there are two general sets of conditions which apply. The first is found in those states which, like New York, Massachusetts and some of the other eastern and perhaps middle western sections, have to deal with a developed traffic problem and have already met with many of the conditions mentioned.

Perhaps Maryland is the best example, for it has a highly developed state system paid for in large part by long term bonds and now maintained from current operating funds. There is no need for further bond issue in Maryland today. Perhaps there never will be. The problem of construction on the state system has been largely dealt with. In such cases there may be a period when short term bond issues will be found advisable in small lots, as often happens in business, but there is no thought that long term issues should be generally imposed where original construction has been advanced as it has in Maryland.

The other condition is that of the southern or western states, where valuations are low, mileage is high and traffic not yet developed. Here the problem is one of construction, largely. The general tax burden is high and any attempt to meet the needs of highway development from current funds would result in so retarding the program that dollars would be lost in diminished or retarded economic development where pennies would be saved.

Is the Increased Cost Justified?

The question which here must be answered is, "Do the increased profits resulting from highway construction under bond issues, offset the difference in cost as between "pay-as-you-use" and "pay-as-you-go" methods of financing?

Looking at this from the viewpoint of the business man suggesting clues to be run down, I want to state at the outset that if you consider this problem from the standpoint of building, let us say 100 miles on a pay-as-you-go policy in 10 years' time as against 100 miles in 1 year with a bond issue, in the first case in 10 years you will have paid all of the principal charges of that 100 mile construction, but will have obtained only an average use of 50 miles for the entire 10-year period, while 100 miles built in 1 year give the use of the entire mileage.

This immediately suggests again the question of the benefits to be derived. In either case it must be assumed that there is to be a benefit, or the program should not be undertaken. The difference then is the interest charged.

Against that there is the 10-year use of the 100 miles, and engineering investigations now under way indicate that the difference in operating costs of transport alone over the good road as against the bad would be sufficient to defray the interest charges many times over, even if we discarded the social benefits which inure.

Who Shall Pay?

Thus far we have discussed as beneficiaries only two general classes, this generation and those that follow. If the highway bond issue plan is to be carried out, however, we must set up the conditions under which these bonds will be issued, and in order to do so we should determine more specifically the question of beneficiaries in order that, in setting up our source of revenue, we shall be as equitable as possible.

At once a new set of questions presents itself for examination.

1. What is the effect of highway improvement upon agricultural valuations?
2. What is the effect of highway improvement upon urban valuations?
3. What is the effect of highway improvement upon the operating costs of the user, the agent of the public?

The answers will vary according to the topographical conditions, economic conditions, the extent and character of the traffic. Each state will have to meet this situation as its own needs demand and these needs can only be finally determined by specific inquiry and investigation upon a very broad scale. There are few today, however, who will deny the influence of highway development upon the farmer. The truck gardener, the dairy products man, and even the producer of heavy staples, has found his markets favorably affected by highway improvement. Perhaps more important, the educational and social advantages derived from highway extension have opened a new vista to all.

Likewise, the development of urban properties and particularly of suburban properties has been perceptibly affected. No one who drives a motor vehicle or a horse will question the beneficial effect of highway improvements.

How far the use of large units made possible by road improvement has affected the economics of all three groups mentioned, is a point which few can discuss

(Continued on page 8)

Highways and the Tax Payer

A Discussion of the Problem of Highway Finance

By A. J. BROSSEAU

President, Mack Trucks, Inc., and Member of Highways Committee National Automobile Chamber of Commerce

IT is becoming more and more apparent that this nation faces the future more seriously in need of efficiency than has ever been our need in the past and real efficiency can only come as a product of imagination and courage. Contemplate, if you please, the lowered standard of living and the desperate economic conditions with which the people of many other nations are contending, then picture the great big major fact that this nation must be forced into economic competition with these nations. If we succeed in holding and retain the hope of improving the standard of living of our agricultural population, the stronghold of this country, it will only be through the exercise of imagination and courage to gain efficiency of operation as essential to a nation as to a private business.

The annual loss due to the lack or to the high cost of transportation imposes upon the business of this country a waste out of all proportion to the cost of remedying the conditions. But it cannot be said that we are today attacking, with the imagination and courage necessary, any one of the fundamental conditions which must be met if we are to have adequate and economical transportation; and by transportation I do not mean railway or highway or waterway transportation alone, but transportation in which all three of these shall meet and each shall serve that purpose which it is best designed to serve, and each shall supplement the other.

Just at this time it is impossible to pass without comment the results of many recent elections. These can only be interpreted as an expression of an economic hurt and resentment which are the outgrowth of the readjustment period through which we are passing. The road problem has been an issue in a number of states. As the returns have come in there has been presented the anomaly of a demand for lower taxes and curtailed expenditures for roads, and at the same time the approval of additional bond issues which can only be met through increased revenues; these happenings in the same state and at the same election. In some instances there is grave doubt as to the economic justification of the highways for which provision was made.

It is certainly not apparent that a reaction against the highway improvement program has been expressed, but rather that a very strong reaction has been voiced against the present economic conditions. In some states there has been more or less pointing to the high cost of the road program as a reason for discontent. The need for long mileages and higher types of highways has developed so rapidly that it has forced the highway officials of the country out in front of the foremost advance of public sentiment, there to become a common target for both the progressive and the conservative elements of our population, speaking not of political parties, but rather of the two general groups into which people divide themselves, based upon their natural reactions to all public improvements. The one element is impatient because of too slow progress,—the other dissatisfied because, first, the improvements are not in the right localities, or second, the wrong political party is receiving credit, or third, the cost is too high. Eliminate these latter contentions, and at least 90 per cent. of all opposition to the highway program of any state is dissipated to the four winds.

The building of highways as an integral and necessary part of highway transportation service, is a serious and a responsible undertaking, and there seems to me to be evidence in plenty that, generally speaking, our high-

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Abstract of an address presented at the Second National Conference on Education for Highway and Transport Engineering held at Washington, D. C., Oct. 28, 1922.

way officials are rising to the needs of the times. But their work must become more certain, and must be directed toward objectives that are better understood if the public is to succeed in building for itself a system of highways that will not fail. Not only is this true, but their work must be directed by those requirements which may be termed fundamental principles underlying the whole structure of transportation in its highway phase. Can we not, out of the experience of the past,—out of the development of railway transportation and the condition in which it finds itself today,—secure the necessary information and guidance that the development of our highway system shall go forward economically and efficiently?

A System of Transportation Needed

Permit me to quote recent testimony from the railroads themselves. Mr. Markham, the President of the Illinois Central Railroad, in New York on November 9 said, in speaking of the complaints which exist with reference to the present lack of rail transportation:

"Some are without justification, but they reflect a nation-wide condition, the existence of which cannot be questioned. There have been other times when the service the railways could render has been unequal to the demands. This was the case, for example, in 1906 and 1907, and in the war years. But in every past time when there was a shortage of transportation, it was felt only after the revival and increase of business had been going on for some time, and had carried production and commerce to higher levels than ever before. What we call 'car shortages' always have represented inadequacy of all railroad facilities. The car shortages of 1906 and 1907 did not come until toward the close of a 10-year period of industrial and commercial expansion, during which the railways had increased by two and one-half times the volume of freight carried by them. The car shortage of the war years did not begin until when, in 1916, the railways were handling twenty per cent more freight than in the previous year.

"The outstanding fact regarding the present shortage of transportation—the significant fact which challenges our attention—is that it has been met at the very beginning of a period of business revival. In this respect it creates a situation unprecedented in the history of the United States—a situation which should cause every farmer and business man, every railway regulating official, every public man, every wage worker, to pause and reflect seriously.

"Nothing less than a revolution has occurred when our railways, whose surplus capacity has always in the past periods of business made possible the vast increases which have occurred in our production and commerce, are found threatening to prove unequal, or actually proving unequal, to the demands made upon them at the very beginning of a period of business revival. The railways are now moving about as much freight weekly as in 1920 when the highest record was made. In spite of this, the car shortage recently reported has been the largest ever known, and the demands of shippers continue to increase. In past periods of business revival, the increase in freight business has gone on until it has reached a point 35 to 150 per cent higher than ever before. We may well ask ourselves whether, with the railways finding it difficult to surpass the freight carrying record of 1920, they can be expected within a few month or years to handle such an increase in tonnage as past experience shows would be only normal in a period of general revival."

This frank recognition and statement of a condition from this high railway source carries the weight of conviction that, under no conditions, can the highways escape an additional burden of transportation which will be thrown upon them, due to the overflow from the railways. It cannot be otherwise. And while the rate of increase in the past has been enormous, we must conclude that this increase is to continue and to become more acute because, as the railways fail to carry the increased business which must be a part of and necessary to business revival, cost will cease to be a governing factor, and the time of the service become the one essential.

We have had recently in the statement of Mr. Lyford, vice-president of the C. & E. I. Railway, for the first time, an expression of constructive ideas as well as specific facts which indicate something of the suplementary relationships which can be established between the highways and the railways. He says:

"Under existing rates the line haul of freight would be highly profitable if the revenue therefrom were not absorbed by constantly increasing terminal charges."

The Relation of the Highways to the Railroads

And among the five specific evils which assist to prey upon the earnings of the line haul of the railways, three are as follows:

"The lack of organized collection and delivery service, making necessary unreasonably large and expensive freight terminal facilities, and an unreasonably large supply of freight cars."

As a specific example he recites the fact that the interest charges alone upon the value of the real estate of the freight warehouse in Chicago at 12th Street impose a charge of $2.50 per ton for every ton of freight which passes through that warehouse.

"Second, the use of box cars for transfer of l. c. l. freight between railway stations and large terminal areas, a service which the trucker could perform more quickly and economically, thereby releasing box cars from an unprofitable service, and increasing the carrying capacity of the railways.

"And third, the operation of branch lines on which traffic is too light to sustain the rail operation,—a service which the motor truck can perform better and at less expense."

All of these specific remedies call for adequate highways, either urban or suburban. Further he states:

"If all of the freight cars which carry loads into the Port of New York, the switching district of New York, and other large terminal areas, could be unloaded on the day of their arrival, they could be loaded out on the same day or the following day, and the present freight-car equipment of the railways would be sufficient to meet all transportation needs for several years to come."

And yet we have believed that we must add greater and greater equipment necessitating higher charges. It seems to me the time has come to use economy in the use of our present investment in railway and highway equipment to the end that we will not build up further interest charges.

Further he states:

"Competition for the local carriage of goods within city and suburban areas ought to be welcome by the railways, as they perform this service at an actual loss, while the trucker can perform it at a profit. On the other hand, competition with the railway for the carriage of goods through the rural districts along the main lines of railway is harmful to the railway and unprofitable to the trucker."

Highway Development a National Problem

Here are briefly, perhaps unadequately sketched certain phases of the transportation problem which are to be met. It is about time that we recognize in this country the fact that the development of adequate highways is not a problem for the farmer, nor is it a problem alone for the city man. It is one of the fundamental transportation problems in every locality, and the use of the roads in every locality will reflect the life and activities of the people in the locality. This is demonstrated beyond dispute by the traffic census which we are now carrying forward. Despite any conditions political or otherwise, highway improvement in this country must go forward on an increased scale because it will cost more to do without the transportation service which can be supplied through the building of highways than it will cost to built and maintain them.

Here is an example (See Table 1) taken from an industrial section. The recent traffic counts in Connecticut and Massachusetts, taken in October which is an average traffic month give an average for each of four stations of 1140 tons of commodities per day of nine hours. Adding one third as a very conservative estimate for the full day, we have 1520 gross tons daily commodity movement, that is. the weight of the commodity and the carrying vehicle.

Table 1—Summary Table of Commodity Movement Connecticut and Massachusetts.

Class of Commodity	Average Haul Miles	Total Net Weight Tons	Percentage Total Net Weight	Ton Miles Net Weight	Gross Weight Tons
Products of Agriculture	**34.5**	**1,094.6**	**8.7**	**39,802**	**2,630**
Products of Animals .	39.4	1,216.1	9.6	48,113	3,121
Products of Mines ...	25.6	669.0	5.4	17,328	1,288
Products of Forests ..	35.2	419.6	3.3	13,970	1,017
Products of Mfr.	49.0	9,151.9	73.0	411,611	23,223
TOTALS		12,551.2	100.0	530,824	31,280

The agricultural tonnage is not large, neither is that of a number of the other activities, but the manufacturing tonnage is the big and important item. The section is devoted largely to manufacturing, and we find reflected the life and activities of the section in the highway commodity movements. Seventy-three per cent of the commodity movement consists of the products of manufacture, the balance being divided between the products of agriculture, mines and forests. From figures which have been published by the Iowa Experiment Station, assuming gasoline to cost 24 cents per gallon, the cost of the fuel alone for moving this tonnage per mile per day would be $26.44 over an ordinary dirt road,—assuming the impossible, that such traffic could be carried over a dirt road. The cost of fuel for moving the same tonnage over a paved road would be $11.70, a difference of $14.74 per day. On the basis of 300 days per year the actual saving in fuel alone moving this tonnage, which comes from the actual weighing of the actual movements, would be $4,022. The paved highway costs approximately $40,000. The average interest at 5 per cent would be $1,000, which, deducted from the actual saving on fuel, would leave a balance which would retire the cost of the road in a little over 11 years. The maintenance costs are not figured in either case, but a greater maintenance charge could be deducted than the roads are actually costing, and still the balance of the saving would be sufficient to retire the cost within what we believe to be a reasonable period for the service of the road without extensive repairs.

Here are the astonishing figures of the cost of an improved highway constructed at prices which are above what we believe will be the general average of such costs, and the saving in the fuel consumption alone is sufficient to pay the cost of the highway plus interest charges plus maintenance, and the tremendous passenger traffic is carried, on this basis, free of cost.

The Functioning of Federal Aid

Here, then, is the functioning of Federal-aid in the development of highway transportation. The Bureau of Public Roads is an agency. It is an agency representing all of the State highway departments, and attempting to enforce the average ideals and standards which are the general average of the experience and the practices in the states which are making the best progress, and these standards are not such that they impose unjust or unnecessary restrictions or requirements on any state in the construction of the Federal-aid highways.

The principles which are being administered are not the standards of one state, but rather the average standards, and it would be manifestly unfair to those states which are standing for the progressive and proper development of their highways to meet their transportation necessities, not to insist that all of the states shall come up to a reasonably uniform standard considering the states by groups. The bureau has no apologies to make for insisting on standards which have been developed through this experience. There is no question that the states should be considered in groups, and the standards of one group should not, and in many cases cannot be applied in other groups, but within the group itself. While the bureau has full sympathy for any retarding condition in which a state finds itself with respect to funds, its organization, or its own laws, the bureau would be open to the most just criticism should it allow that state to fall below the standards of the area in which the conditions are common and continue to participate in the federal road funds. The bureau is earnestly endeavoring to define the areas in which like conditions prevail and to place justly the states in these areas. So far as is possible only those standards which are necessary to the development of the transportation needs of the area will be insisted upon, but there is little sympathy for a state which lags for years behind the other states in any group. It would not be a kindness, and it would only result in detriment to the progress of highway development in this country as a whole, to condone or fail to enforce in any state the standards that are agreed upon as necessary to the group. This position seeks only to express the experience and viewpoint of the majority

(Continued on page 10)

Current Events in the Field of Highway Engineering and Transport

Conference on Highway Engineering to be Held at University of Michigan

Beginning Feb. 12th and continuing until the 15th the Ninth Annual Conference on Highway Engineering will be held at the University of Michigan, Ann Arbor, Michigan. The conference will be under the direction of the College of Engineering in co-operation with the Michigan State Highway Department and the Michigan Association of Road Commissioners and Engineers. Both morning and afternoon sessions will be held, and the conference will close with an informal dinner on Thursday evening.

The purpose of the conference is to aid in supplying to road commissioners and engineers information relative to highway administration, organization, financing, traffic, drainage systems and foundations, and the construction and maintenance of roadways and bridges suitable for roads and streets in the State of Michigan. During the sessions, ample opportunity will be afforded for discussions. The conference will be open to all road commissioners, engineers and others interested in highway construction and maintenance.

Through the courtesy of the Highway Education Board of Washington, D. C., there will be on exhibition during the conference, a Good Roads and Highway Transport Exhibit consisting of a set of twelve models of roads, pavements and bridges prepared by the U. S. Bureau of Public Boards and a rubber exhibit prepared by the Firestone Tire and Rubber Company. The road and pavement models are so designed as to show each step in the construction of the road or pavement from the compacted subgrade to the finished surface. The bridge models are so designed as to show the relation of the structure to its foundation and also by cutting out sections of the structure, the details of its construction.

NEVADA TO IMPROVE SCENIC LINCOLN WAY ALONG LAKE TAHOE

The Nevada State Highway Department engineers recently completed mapping and surveying the proposed highway improvement from the California state line to Glenbrook along the shore of Lake Tahoe, via Cave Rock. This is the south route of the famous Lincoln Highway between Fallon and Sacramento.

It is reported that the new highway will follow the old route, eliminating curves and bad turns in the forest, which, in view of the increasing traffic, are becoming dangerous. Some consideration has been given to driving a tunnel 400 ft. in length through Cave Rock to eliminate the present bridge built around the edge of the great cliff extending over the lake and which has been maintained by Douglas County for years. This proposal has met with strenuous opposition, however, from resort owners along Lake Tahoe who claim that the bridge affords one of the most scenic spots found in this beautiful region and one greatly admired by all tourists.

MISSOURI HAS WINTER LETTING OF ROAD CONTRACTS

Over $5,000,000 in Highway Contracts Recently Let—Another Letting in January

That the Missouri Highway Commission would let contracts through the winter as rapidly as the plans and specifications could be prepared was the statement made by B. W. Piepmeier, chief engineer, at the letting of over $5,000,000 worth of work on December 2. This included 86 projects, a part of the $6,000,000 program of the state.

To illustrate the value of detailed engineering work necessary to prepare for a large letting of road contracts, Mr. Piepmeier said his department had made 17,882 blue prints, requiring six and one-fourth miles of blue paper.

Another group of contracts will be let early in January.

4,200 MILES OF CONCRETE PAVING PUT DOWN DURING 1922

The past construction year—with all its troubles in the form of bad weather, railroad strikes and consequent material shortages—has seen another big advance in the amount of new concrete pavement placed at the service of the American people. Nearly sixty-two million square yards have been completed and opened to traffic. More than two-thirds of this amount was placed on the highways—the equivalent of 4,200 miles of road eighteen feet wide. Over seventeen and a quarter million square yards were laid in cities for street and alley pavement.

Back at the beginning of the year, there were 22,600,000 square yards of concrete pavement under contract and uncompleted—hold-over work from the 1921 season. That year was almost ideal from the contractor's standpoint—a long season of good construction weather, no railway troubles to speak of, and plenty of labor. The amount uncompleted at the end of the year was relatively small.

Generally conditions have not been so favorable during 1922. In many states, spring rains continued in such volume into May and even June, that active work could not be started. Good weather prevailed generally during the summer, but about August 15th the effect of the coal strike and the railway shopmen's strike began to be felt to such an extent as to shut off the supply of materials.

Taking all of these delays into consideration, it seems reasonable to estimate the 1922 working season at not more than four and one-half months, as against a working season of nearly seven months during the previous year. As the total production of concrete pavement in 1921 was only slightly larger than in 1922, it seems evident the contractors of the country have increased their capacity this year. In other words, concrete pavement production in 1921 was at the rate of about eight and one-half million square yards per month, while this year it has been at the rate of thirteen and three-quarter million square yards every month. This is equivalent to more than 1,300 miles of concrete pavement eighteen feet wide, and represents an achievement unequaled in any other branch of the construction industry.

INDIANA STATE HIGHWAY COMMISSION ADDS 16 MILES TO ROAD 31

The Indiana State Highway Commission has taken over approximately 16 miles of road between Danville and Indianapolis for continuation of state road No. 31 from Danville to the Capital. Some of this new mileage is concrete and was completed in 1922. With the new acquisition State Road No. 31 continues from Danville almost due east to Indianapolis. Formerly it swung to the southeast and connected with the national road at Plainfield and thence to Indianapolis.

Traffic has become so heavy on the National Road that the highway commission is now endeavoring to divert some of it, and continuation of Road 31 is the only solution for it gives two instead of one direct route to Indianapolis from that part of the state.

State Road No. 31 is destined to become a most important and heavily traveled highway by reason of its transcontinental connection at Chrisman, Ill., with a concrete highway leading to Chicago and also from its western connection with a road crossing Illinois.

$8,000,000 SPENT IN 1922 ON LINCOLN HIGHWAY

The Lincoln Highway Association is now compiling with care reports, from the eleven states and ninety-six counties traversed by the transcontinental road between New York and San Francisco, detailing the expenditures made on the improvement of the Highway during 1922.

A. F. Bement, Vice-President and Secretary of the Lincoln Highway Association, estimates that when these figures are fully compiled they will indicate the investment of over $8,000,000 in the improvement and maintenance of the Highway during the past twelve months, bringing the total expended in bettering "America's Main Street" during the nine years between 1913 and 1923 to over $50,000,000.

Complete tables showing the location, type, cost and extent of each section of improvement accomplished on the Lincoln Highway between the Atlantic and the Pacific during 1922 will be published by the Association late in January. Those interested in American highway construction follow the progress on the Lincoln Way each year with special interest as it reflects very well the progress of highway work in the United States as a whole, bisecting as it does the heart of the Union.

CANADA BUILDS 5700 MILES OF GOOD ROADS IN 1922

Good road work aggregating 5786 miles was undertaken in Canada in 1922, according to a report of the Dominion Commissioner of Highways. This work which was practically all completed by the end of the year was carried out under agreement between the federal and provincial governments, at a cost of nearly $40,000,000.

Road improvement in the western provinces was most pronounced, due, it is said, to the expansion of agriculture resulting from greatly increased settlement of lands. Saskatchewan had 1,434 miles of road under construction in 1922, leading the other provinces by 200 miles, the commisioner's report shows. Manitoba followed with 796 miles of road. Ontario had 629, Quebec 556, Nova Scotia 435, British Columbia 368 and Prince Edward Island 338.

The statement of federal aid road work did not include Alberta, where the Highways Commission has not yet been constituted. Under the federal aid arrangement the various provinces undertake road work. The Dominion government inspects the roads and on approval of the work pays 40 per cent. of the cost, under a five year road building appropriation. The provinces pay 60 per cent. Roads under construction included county and municipal roads, main highways and trunk lines.

One of the outstanding features of the road program last year was the completion of the last fifty miles of the Banff-Windermere road. This highway will connect Canada's national parks and link up for motor tourists the Grand Canyon, Yellowstone and Glacier parks with Banff. The highest crossing of the road which is 500 miles long is at Vermillion Summit, just south of Castle, B. C., 5,264 feet above sea level.

MINNESOTA ROAD FUNDS LESS THAN THOSE IN MANY OTHER STATES REPORTS INDICATE

Minnesota, although widely known for good roads, is using less money for highway betterments than many other states. Its current trunk highway funds averaged about $7,500,000 a year to date under the new program—$5,616,000 of motor vehicle taxes and $1,415,000 of federal aid in 1921 and $6,500,000 of taxes and $1,450,000 of aid in 1922. Good roads funds in other states are added from listings believed reliable.

Texas with $100,000,000 of highway bonds used $50,000,000 in 1921 and began on the second $50,000,0000 this year, taking from Minnesota the distinction of having the largest mileage of completed federal aid highways. Pennsylvania voted $100,000,000 bonds for a four year program and used $40,000,000 in 1922. North Carolina voted $50,000,000 for 5 years and used $22,000,000 the first 8 months of 1922. Illinois used more than $5,000,000 of bond money in 1921 and 1922 in addi-

(Continued on page 8)

OFFICIAL PROPOSALS

HIGHWAY WORK

Notice to Contractors

TRUCK SCALES

SEALED PROPOSALS will be received by the State Highway Department, at its office, Dover, Delaware, until 2 o'clock P. M., January 3, 1923, and at that time and place publicly opened for furnishing and installing a 20 ton Howe or Fairbanks Auto Truck Scale, with platform 20x9 feet, approximately one mile south of Hares Corner on the Coleman duPont Road.

Performance of contract shall commence within ten (10) days after execution of the contract and be completed on or before March 31, 1923.

Monthly payments will be made for 90 per cent of the construction completed each month.

Bidders must submit proposals upon forms provided by the Department.

Each proposal must be accompanied by a surety bond, certified check, or money to the amount of at least ten (10) per centum of the total amount of the proposal.

The envelope containing the proposal must be marked "Proposals for Track Scales."

The Contract will be awarded or rejected within twenty (20) days from the date of opening proposals.

The right is reserved to reject any or all bids.

Detailed plans may be seen and index plans and specifications may be obtained upon deposit of ten dollars ($10.00) which amount will be refunded upon return of plans and specifications in good condition at the office of

STATE HIGHWAY DEPARTMENT,
Dover, Delaware.

HIGHWAY WORK

Notice to Contractors

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M. on Friday, the twelfth day of January, 1923, for the improvement of highways in the following counties:

ALLEGANY ....(one highway—2.11)
CATTARAUGUS,
(two highways—1.97 & 7.63)
CAYUGA & TOMPKINS,
(one highway—2.80)
ONEIDA ....(one highway—2.75)
ONTARIO ....(one highway—0.41)
RENSSELAER ....(one highway—4.89)
ROCKLAND ....(one highway—3.69)
STEUBEN ....(one highway—5.22)
ULSTER ....(one highway—5.51)

Also for the reconstruction of the following:

FULTON ....(one contract—1.50)
RENSSELAER ....(one contract—2.42)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offiffice of the division engineers in whose division the roads are to be improved or reconstructed. The addresses of the division engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
Secretary.

Equipment—Trade—Materials

NORTHWEST ENGINEERING CO. PRODUCES SHOVEL WITH A SINGLE MOTOR

For many years contractors have wished for a shovel that would dispense with the separate crowding engine or motor with attendant short lived gears and racks or sprockets and drive chain.

Such a shovel is now manufactured by the Northwest Engineering Co. of Chicago. The separate crowding motor has been eliminated in an almost unbelievably simple way. All high maintenance complications are replaced by an ingenious rig of cables controlled by the same drums that are used for hoisting. This makes the full hoisting power of the heavy duty gas engine or electric motor available for crowding; and it results in 15 to 25 per cent greater power at the dipper lip.

Although this mechanism fulfills every function of a separate crowding engine—thrusting in and out and shaking the dipper—its only wearing parts are cables and drums which are subjected to no more punishment than the hoisting cables in ordinary shovels.

To anyone who knows the Northwest Crawler Crane and Dragline it is not necessary to say that the Northwest Shovel is not an experiment. The shovel has been offered for general sale only after exhaustive tests in the field have shown its construction and operation to be equal to its revolutionary design.

WARREN BROTHERS COMPANY TO MOVE ITS NORTHWESTERN BRANCH OFFICE

Warren Brothers Company announces the removal on December 31, 1922, of its Northwestern Branch offices from the Pacific Bridge Building, 289 East Salmon street, Portland, Oregon, to its new quarters on the 11th floor of the Porter Building (fomerly Wells Fargo Building), at the southwest corner of Sixth and Oak streets, Portland.

On and after that date, the company's mail and telegraph address will be Warren Brothers Company, 1115 Porter Building, Portland, Oregon. The address of Warren Brothers Company Laboratory will remain the same as heretofore, namely, 289 East Salmon street, Portland, Oregon.

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(Continued from page 3)

fully yet, particularly with regard to road improvement costs, but here again there is a definite problem to be worked out.

General Taxes for General Benefit

So that while the relative amounts may differ, it seems that any fair plan for construction should be based upon general taxes for construction purposes, since all classes are enumerated in the three broad divisions mentioned.

When maintenance is considered, however, a different answer presents itself. The damage to the wearing surface is done by traffic. Traffic benefits first by maintenance in lowered operating costs, so traffic should be expected to meet this levy.

Yet at once the question arises as to what is maintenance?

> Shall we say that a manufacturer building a new plant or installing new machinery to take care of increased business, should consider that an item of current expense?
>
> Could the farmer or business man who attempted to assess such costs against his crop or output in a single year, expect the buyer to pay it cheerfully?
>
> Likewise would the extension of a highway or its widening be an item in maintenance or construction?

There seems to be a close parallel in these two instances and undoubtedly where cases of this kind occur, ordinary business practice will prevail.

The same problem presents itself when a road is lifted from a low to a higher type to the extent of the difference in cost.

(Continued on page 9)

(Continued from page 7)

tion to $17,500,000 a year in motor vehicle taxes and federal aid. Missouri has $116,000,000 available for roads, $16,000,000 direct appropriation and bond authority and federal aid for the balance. California voted $40,000,000 bonds and used $1,500.000 on a 30-mile project. One county in Arizona has completed 308 miles of paving at $8,500,000. In Florida, two counties spent $3,000,000 each on roads and are now adding $5,000,000 more for connections.

Highway bonds voted include $40,000,000 in New Jersey, $12,500,000 in Oregon, $25,000,000 in Alabama, $5,000,000 in West Virginia, $10,000,000 in Maine, $4,500,000 in South Dakota, $4,000,000 in Utah, $2,800,000 in Wyoming, $2,000,000 in Idaho and $1,000,000 in Nevada. Michigan has used $50,000,000 on important road work in 5 years. Georgia has increased its funds $750,000. Kentucky, Louisiana and Mississippi have outstanding each nearly $1,000,000 of road contracts. Tennessee is campaiging for a $75,000,000road bond issue and good roads campaigns patterned after the Minnesota plan are on in Kansas and North Dakota.

Ten million six hundred and twenty thousand four hundred and seventy-one motor vehicles were registered in the United States on July 1, according to the U. S. Bureau of Public Roads.

There are 2,500,000 miles of rural highway in the United States.

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1 Haiss wagon loader, gasoline driven.
1 Erie, type "B" combination crane and shovel.
2 75 H. P. locomotive type boilers, on skids.
1 100 H. P. locomotive type boilers on skids.
1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
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4 6 ton, 24 in. ga Cummings locomotives.
2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.
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1 No. 11 Koehring Paver, wheel traction.
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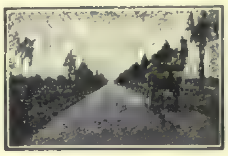

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(Continued from page 8)

Regulation Must be Flexible

Another consideration which must be made a matter for thorough study is found in regulation of traffic on the highways. The whole question of finance is tied up in this point, because, after all, the only justification for any highway improvement, as I have already noted, is the service which the highway renders and that service should be permitted to grow without restraint as long as it is sound economically.

If we restrict traffic unwisely, maintenance costs may be less, but transport operating costs may be swelled out of all proportion, and since the public pays the bill in any case, we should seek to make highway transport in its entirety function at the lowest possible cost.

Here we can suggest a prolific field for investigation. Overloading apparently damages both road and vehicle. Seasonal limitations appear to be necessary under certain conditions, and still with a railroad congestion such as obtains today, which is of the greater public moment—the maintenance of a low grade highway surface, or its destruction by goods which must be moved?

There should be definite restrictions on maximum loads, of course, at least until the highway builder can catch up with the highway user—a goal still far in the future—but it is not necessary to consider that phase in detail now.

Suggested Financial Policy

Personally, I should say that subject to varying conditions of highway development, of valuations, population and traffic in the several states, the program resolves itself into this:

1. The preparation of a "construction budget" by every state, estimating the cost of the primary and secondary roads to be built, year by year, for the next ten years.

2. That based upon the stage of development of that program at this time, the cost of construction—all or part—shall be met by bond issues, except in those states where the construction program is practically complete.

3. That a budget of current operating costs be set up to defray—interest on bonds, amortization charges, and maintenance. The amount necessary to pay interest and amortization should be included in the general tax levy. The cost of maintenance should be assessed against the user.

4. That all expenditures should be under the control of the state highway departments.

5. That regulatory powers should be as flexible as possible and lodged only within the state highway department, to be administered in accordance with the needs of the public.

Sound Bond Methods

As a summary for consideration where state highway bond issues are necessary, I suggest that:

1. Bond issues should be serial in form and issued for as long a period as fifty years. The fund should be expended under rigid engineering control, and provision must be made for sufficient current income to pay interest, amortization charges and adequate maintenance.

2. Interest on bonds and amortization should be paid for from general taxation. Maintenance costs should be charged against traffic.

3. Maintenance shall include all charges up to and including reconstruction, save extensions or added re-

(Continued on page 10)

(Continued from page 9)

placement costs where an inferior is replaced by a superior type of surface.

4. Only that type of road shall be constructed which is adequate for the needs of present and future traffic. This shall be determined by careful surveys both of traffic and of economic possibilities.

HIGHWAYS AND THE TAX PAYER

(Continued from page 5)

of the states—the foundation principle upon which this government was built, and upon which all our institutions have been developed. It is only the application of the theory which underlies our whole form of government.

Federal-aid is functioning in a major way to accomplish these larger purposes by fixing our efforts for the time upon the completion of the Federal-aid highway system. It is requiring, and must in the future be more strict in requiring, that the states shall maintain adequate highway departments. The application of Federal-aid has proved to be sufficiently flexible to adapt itself to the needs of the different states, and to be readily adjusted to the character of highway development needed in the metropolitan areas as well as in the strictly rural sections of the country. In requiring adequate maintenance the bureau seeks only to secure the maximum of highway service and to protect the investment without which our highway program cannot continue to receive the support of the public. The bureau seeks only those fundamental requirements of location, alignment, and freedom from railroad grade crossings that are essential to the upbuilding of an adequate highway system. This fact must never be lost sight of, that as the present stretches of highways are connected by the building of the intervening sections, the traffic over the individual highways will become greater until it reaches a point of stability which will only be changed by the completion of new routes in contiguous territory, so that not only freedom from danger is sought, but economy and continuity of operation are essential requirements.

Finally, the bureau does not attempt to dictate the highway policies of the several states, but rather to reflect the standards and policies which a majority of the state highway departments are using, developed out of experience and the expenditure of large sums of money, as necessary and essential to the proper development of the highway systems within the individual states. In the administration of the whole of the Federal-aid work, the bureau attempts to give each state the benefit of the best thought upon all its problems, drawing upon one state for ideas that will be helpful to another, and extending to all alike a coordinating service through which it is hopeful that all states may be brought to a higher level of efficiency and attainment.

Texas and New York are the states which receive the largest allotment of Federal aid for highways, which is distributed on the basis of population, area, and mileage of rural highways.

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CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded, January 1892

E. L. POWERS, Editor
E. W. TREE, Managing Editor

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TABLE OF CONTENTS

Thirteenth American Good Roads Congress Opens in Chicago, January 15th 7
The Fourteenth Annual Good Roads Show 14
Special Features of the 1923 Show and Convention . 18
New Filler Material Will Hide Joints in Concrete Pavements 19
Fire Protection in Highway Bridges 20
A Concave Concrete Pavement 21

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Good Roads Plans to be Feature of Coming Session of Minnesota Legislature 22
Illinois Adopts New Design for Concrete Roads . . 22
Plan Permanent Highways Along Mississippi . . . 22
Country Should Allow for Future Traffic in Building Roads, Says U. S. Bureau of Public Roads . . 22
Illinois Completes Paving on Important Section of Lincoln Highway 22
Texas Highway Contracts Total $2,000,000 During Last Three Months 23
U. S. Bureau of Public Roads Plans Rural Engineering Research 23
Arkansas Has 28,700 Miles of Improved Roadways . 23
California Highway Commission Asks $135,000,000 for Roads 23
Wisconsin Road School to Open January 22nd . . . 23
Ohio Will Keep Roads Clean This Winter 24
All Records for Road-Building Broken During 1922 Says U. S. Bureau of Public Roads 24
Two Highway Bills to Be Submitted to Montana Legislature 24
Footpaths Proposed for New Jersey Roads 24
Paving of Model Stretch of Lincoln Highway Completed 25
Colorado Plans Big Road Budget for 1923 25

EQUIPMENT—TRADE—MATERIALS

New Bulletin on Koehring Crane Excavators No. 2 and No. 3 25
Austin Produces a New Asphalt Plant 25
Hais Manufacturing Company New Creeper Wagon Loader 26
TRADE PUBLICATIONS 26
PERSONAL MENTION 26

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PROFITABLE because you can build a complete system of roads in your city or county, unit by unit, without finding that the early units are worn out before the last are completed.

PROFITABLE because the mineral aggregate is available at or near the work, and expensive freight and truck hauls are eliminated.

PROFITABLE because its mineral aggregate is so finely divided that National Pavement will withstand the heavy, sledge-hammer blows of traffic without breaking down.

PROFITABLE because the wearing surface is impervious to water and does not have to be repaired for this reason.

PROFITABLE because it has a longer life than any other asphalt pavement on account of its high penetration of softer asphalt.

PROFITABLE because it stays put; the action of traffic improves rather than injures its surface; it does not wave, creep or flow under the shoving action of heavy traffic.

PROFITABLE because it increases public confidence in the contractor who lays it, and brings him new contracts.

PROFITABLE because it saves automobile tires, reduces jarring shocks which eventually wreck automobile springs, axles, transmissions, and engines, and is free from dust—all factors that every driver will heartily appreciate.

PROFITABLE because it was designed to overcome, and does overcome, the inherent weakness of all other types of road.

Write for Illustrated Book

National Pavements Corporation

60 Broadway, New York City

GOOD ROADS

The Journal of Highway Engineering and Transportation

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIV JANUARY 10, 1923 No. 2

Thirteenth American Good Roads Congress Opens in Chicago, January 15th

Annual Convention and Good Roads Show of American Road Builders' Association Promises to Surpass those of Previous Years

To the Roadbuilders of America

SO extensive has the highway improvement program become in this country that road building now takes rank as one of America's foremost industries. Whereas automotive development once led to better roads, good roads are now stimulating the sale of automobiles. It is not now so much a question of obtaining funds for new highways as it is of spending wisely the funds we have.

In an effort to keep pace with the growth of our industry the American Road Builders' Association, the oldest and largest organization of its kind in the country, has developed its annual machinery exposition to the point where there is now scarcely a building anywhere in this broad land large enough to accommodate it.

The coming show and congress, or convention, to be held in conjunction with it, promise to be the greatest in number of exhibits, the largest in point of attendance and the most important in educational value of any ever held by our association. All of the old features have been retained and many new and novel ones have been added. The annual banquet will be a most sumptuous, entertaining and instructive affair and the other special entertainment features that have been provided for delegates and guests during the week will by far surpass those of any previous road builders' convention.

As president of the American Road Builders' Association for the current year, I extend a most cordial invitation to all road building contractors, engineers and public officials and all other persons who are in any wise interested in highway improvement to attend our great congress and exposition in Chicago. Your attendance will be more than worth while. It will be profitable. And be assured that a hearty welcome awaits you.

T. J. WASSER.

T. J. WASSER,
President, American Road Builders' Association, 1922-23.

NEXT week in Chicago, from January 15th to 19th, the American Road Builders' Association will hold its thirteenth American Good Roads Congress, its twentieth Annual Convention and its fourteenth Annual Good Roads Show and Highway Industrial Exhibit. The Convention and technical sessions will be held this year in the Congress Hotel instead of at the Coliseum, as heretofore, as the association believes this arrangement will insure much better attendance at the sessions since there will be no interruption due to the Good Roads Show. This new arrangement it is felt will also eliminate the noises which have heretofore been so disturbing to speakers and delegates. The Annual Good Roads Show, however, will be held in the Coliseum as formerly. So great has been the demand for exhibition space that practically every foot of the 40,000 available feet in the Coliseum and Annex have been taken.

The official delegates to the Congress and Convention will include not only members of the American Road Builders Association but also representatives of the United States Government, as well as officials designated by the various governors of the states and representatives from the Canadian provinces. Delegates from many county boards of commissioners, educational institutions and organizations affiliated with the Good Roads Movement will likewise be represented, and in addition the mayors of some 5000 American and Canadian cities have been requested to appoint delegates. It is therefore expected that the attendance at this year's Congress and Convention will surpass that of all previous Good Roads meetings.

The road building industry in this country has become so extensive, and so vast is the future program of highway improvement that the Thirteenth Good Roads Congress will without doubt mark a new epoch in the nation's development of its roads. Approximately one billion dollars are now being spent annually in the

United States for new roads and streets, a sum far greater than was spent for railroads during their greatest era of expansion. But notwithstanding that the road building program is so enormous, highway improvement still lags behind development of highway transportation. The development of the automobile and the motor truck, according to highway officials and automotive engineers, has forced good road construction until it is difficult now to tell whether the automobile is causing the increasing demand for better roads, or whether good roads are responsible for the increasing demand for the motor car.

J. H. MACDONALD,
Treasurer of the American Road Builders' Association 1922-23

Greetings from James H. MacDonald

IN an obscure little office in the City of New York, the American Road Builders' Association was organized twenty years ago. I have been a member of the association since its birth and I can truthfully say that the organization has been actively at work during all the time that has intervened—at work continuously extending the propaganda of highway construction by word and deed, with the result that each year has seen state after state come into line and make appropriations for the improvement of the highways until today every state in the Union has a state highway commission or some other form of highway control for which it is making appropriations.

It affords me great pleasure to extend to all road builders a hearty invitation to attend our convention and industrial show at Chicago, January 15 to 19, 1923. When the president of the association calls the convention to order we hope he will be confronted by one of the largest audiences ever assembled upon a similar occasion and the wheels of the great machines on exhibition at the Coliseum will spring into action with all the modern equipment with which roads are constructed, on display.

You may rest assured that the social side of the convention has not been neglected. A special committee of local citizens has provided a wide variety of entertainment for all who may be in attendance. Nine great committees are also bending every energy and sparing no expense in an effort to make this convention a notable social as well as a positive business success.

Being a member of the Convention and Show Committee and therefore in close touch with all the details, I can say with the utmost assurance that nothing will be left undone for your comfort and pleasure while attending any of the functions during the convention. When you return to your homes we want you to feel that you have spent a very profitable week, that you have made many new and desirable acquaintances, and that you have enjoyed special courtesies and privileges long to be remembered.

There is so much to see, so much to learn, so much to enjoy and so many good fellows to meet, no road builder can afford to miss these big events. Come one, come all. A hearty welcome awaits you.

Sincerely,

J. H. MACDONALD.

All of these questions will be discussed at the Chicago meeting, together with such subjects as methods of financing road improvement, safety on the highways, progressive methods of construction, obligations of highway departments to the public, traffic regulations, results of testing the various types of roadway, development of apparatus for testing roads, the use of local road building materials, subgrade designs, haulage methods in highway construction, time losses in completing new roads road building in winter, highway maintenance, salvaging old roads, tourist traffic as a factor in highway development, changes needed in motor vehicle legislation, highway research and cooperation between state and county highway departments and between engineers and contractors.

A strong technical program has been prepared for this year's convention. The old idea of a session on bituminous roads, another on concrete, a third on brick, and so on, has been entirely eliminated and the program outlined for 1923 will be the exact opposite of what has previously been presented. Controversial subjects will not be avoided, but on the contrary will form the main topics of the Convention, for it is on just such topics as these that there is need for free and frank discussion.

The Opening Session

The opening session of the Convention will be held on Tuesday morning, January 16th, in the Congress Hotel. Thomas J. Wasser, State Highway Engineer of New Jersey, and President of the American Road Builders' Association, will preside. The opening paper will be presented by Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads. Mr. MacDonald's paper, "Continued Highway Expenditures Required to Meet Traffic Demands of the Future," is a particularly appropriate introduction to the technical proceedings of the Convention, as he will stress the fact that notwithstanding the enormous program of highway improvement, road building still lags behind extension in the use of motor vehicles and if even the present ratio is to be maintained continued highway expenditures are necessary. No highway authority has a more complete realization of this fact than Mr. MacDonald and no one senses more clearly the danger of popular reaction against continued large highway expenditures which is beginning to manifest itself.

Papers will also be presented by C. M. Upham, State Highway Engineer of North Carolina and C. Coykendall, Assistant Chief Engineer of Iowa Highway Commission on the "Progressive Construction of Highways." Both of these engineers will tell of the experiences of their respective states in the progressive construction of highways and how with very little money to spend and very many miles of highway to care for their state road officials were able to accomplish much by following the principle that for every dollar spent to keep the roads in shape, some fraction should be set aside to create permanent highways.

The final paper of the morning session will be presented by H. E. Hilts, Acting Chief Engineer of the Pennsylvania State Highway Department, on "The Obligation of the State Highway Department to Keep the Public Sold on Highways." Careful observers of public sentiment on highway expenditures sense a growing popular reaction against increased appropriations and the public, therefore, must be kept constantly "sold" to the idea that road building is a wise investment. To sound a ringing call for more intensive "road selling" by state departments is the purpose of Mr. Hilts' paper.

Session on Design

The Tuesday afternoon session, over which Thomas H. MacDonald will preside, will be devoted entirely to the subject of the design of roads. As a preliminary to the proper design of roads research and tests are

OFFICIAL PROGRAM

Thirteenth American Good Roads Congress

Under the Auspices of the

American Road Builders' Association

Congress Hotel, Chicago, Ill.

January 16, 17, 18 and 19, 1923

OPENING SESSION

Tuesday, January 16, 10 A. M.

Chairman—Thomas J. Wasser, State Highway Engineer of New Jersey, President, American Road Builders' Association.

President's Address.

Greeting and Inspiration.

James H. MacDonald, Treasurer, American Road Builders' Association.

Continued Highway Expenditures Required to Meet Traffic Demands of the Future

Thomas H. MacDonald Chief, United States Bureau of Public Roads, Washington, D. C.

Progressive Construction of Highways.

(a) Practice in North Carolina—C. M. Upham, State Highway Engineer, North Carolina.

(b) Practice in Iowa—C. Coykendall, Assistant Chief Engineer, Iowa Highway Commission.

The Obligation of the State Highway Department to Keep the Public "Sold" on Highways.

—H. E. Hilts, Acting Chief Engineer, Pennsylvania State Highway Department, Harrisburg, Pa.

DESIGN

Tuesday, January 16, 2:30 P. M.

Chairman—Thomas H. MacDonald, Chief, United States Bureau Public Roads.

What Test Road Results Have Taught Us.

(a) Bates Test Road—Clifford Older, State Highway Engineer of Illinois, Springfield, Ill.

(b) Pittsburgh Test Road—Lloyd Aldrich, Consulting Engineer, San Francisco, California.

(c) Arlington Tests—A. T. Goldbeck, Engineer of Tests, United States Bureau of Public Roads, Washington, D. C.

Development of Apparatus for Field Testing of Roads. —H. F. Clemmer, Testing Engineer, Division of Highways, Springfield, Ill.

Development in the Use of Local Materials.

—Vernon M. Pierce, District Engineer, United States Bureau of Public Roads, Washington, D. C.

Designed Subgrade.

—C. M. Upham, State Highway Engineer, Raleigh, N. C.

CONSTRUCTION

Wednesday, January 17, 10 A. M.

Chairman—J. H. Cranford, President, Crawford Paving Company, Washington, D. C.

Haulage Methods in Highway Construction.

Industrial Railways—A. J. Parrish, General Contractor, Paris, Ill.

Heavy Truck Haulage—Charles H. Fry, Charles H. Fry Construction Co., Erie, Pa.

Light Truck Haulage—A. E. Horst, Henry W. Horst Co., Rock Island, Ill.

How to Equip and Operate Local Gravel Pit to Produce Concrete Aggregate.

—H. E. Kuelling, Construction Engineer, Wisconsin Highway Commission, Madison, Wis.

How Much Time is Lost in Delays in Highway Building?

H. K. Davis, Chief Inspector, Iowa Highway Commission, Ames, Iowa.

Discussion—B. H. Piepmeier, State Highway Engineer of Missouri, Jefferson City, Mo.

What Road Building Work Can Be Done in Winter?

—John H. Mullen, Chief Engineer, Minnesota Highway Department, St. Paul, Minn.

Wednesday Afternoon, January 17—No Session.

MAINTENANCE

Thursday, January 18, 10 A. M.

Chairman—A. R. Hirst, State Highway Engineer, Madison, Wis.

Organization of Intensive Maintenance on a State Highway System in Eighteen Months

—Frank Page, Chairman, North Carolina State Highway Commission, Raleigh, N. C.

Four Years' Experience with Patrol Maintenance in Wisconsin.

J. T. Donaghey, Maintenance Engineer, Wisconsin Highway Commission, Madison, Wis.

Gravel Road Maintenance Practice in Michigan.

—L. H. Nielsen, Deputy State Highway Commissioner of Michigan, Lansing, Mich.

Blade Grader and Road Drag Earth-Road Maintenance in Iowa.

—W. H. Root, Maintenance Engineer, Iowa State Highway Commission, Ames, Iowa.

(Program continued on following page)

OFFICIAL PROGRAM—Continued

Salvage and Maintenance of Macadam Roads.

—W. A. Van Duzer, Assistant Maintenance Engineer, Pennsylvania Highway Commission, Harrisburgh, Pa.

Discussion—A. W. Muir, Superintendent of Maintenance, New Jersey Highway Commission, Trenton, N. J.

TRAFFIC

Thursday, January 18, 2:30 P. M.

Chairman—Thomas J. Wasser, State Highway Engineer, New Jersey.

Tourist Traffic as a Factor in Highway Development (Illustrated).

—A. R. Hirst, State Highway Engineer of Wisconsin, Madison, Wis.

Changes Needed in Motor Vehicle Legislation and License Fees.

—J. N. Mackall, Commissioner of Roads, Baltimore, Md.

Discussion—Leon C. Herrick, Director of Highways and Public Works, Columbus, O.

—Harry Meixell, Jr., New York, National Automobile Chamber of Commerce.

Election of Officers
Business Meeting

FINANCE AND MISCELLANEOUS

Friday, January 19, 10 A. M.

Chairman — Frank Page, Highway Commissioner of North Carolina.

Have Large Expenditures Changed the Public Attitude Toward Highway Development?

—S. E. Bradt, Former Superintendent of Highways of Illinois.

Co-operation Between State and County Highway Departments.

—L. C. Herrick, Director of Highways and Public Works, Columbus, Ohio.

How Individual Organizations Can Fit Their World Into the Broad Highway Research Program

—W. K. Hatt, Director, Highway Research Committee, National Research Council, Washingto, D. C.

necessary and three great field testing operations on full-size paved roads have now been advanced to a point where conclusions are warranted. These roads are the Bates Road in Illinois, the Pittsburgh Road in California, and the Arlington test roads at Washington, D. C. Clifford Older, State Highway Engineer of Illinois, will tell of the work on the Bates Road; Lloyd Aldrich, a consulting engineer of San Francisco, California, will discuss the tests on the Pittsburgh Test Road, and A. T. Goldbeck, Engineer of Tests, U. S. Bureau of Public Roads, will tell of the work at Arlington. These three papers will undoubtedly put engineers further ahead toward the rational design of paved roads than any other information which has heretofore been published.

With the development of field road testing there has also been created a number and variety of testing devices quite remarkable for their ingenuity and elaborate character. One of the leading inventors in this field, H. F. Clemmer, Testing Engineer of the Division of Highways of Illinois, will describe the outstanding features of this new apparatus in a paper on "Development of Apparatus for Field Testing of Roads."

As road building programs increase greater difficulty and expense is experienced in getting service from commercial producers of the customary aggregates for concrete. This had led to investigations which have disclosed a number of materials which can be obtained locally and which make suitable aggregates. This topic will also be discussed during the second session by Vernon M. Pierce, District Engineer, U. S. Bureau of Public Roads, in a paper entitled "Developments in the Use of Local Materials."

The final paper of the Tuesday afternoon session will be presented by C. M. Upham, State Highway Engineer of North Carolina. His topic, "Designed Subgrade," is a particularly pertinent one at this time, for with the increasing mileage of roads on which a costly pavement super-structure is demanded, the question of grade design has assumed great significance.

Session on Construction

The morning session on Wednesday, January 17th, will be devoted to a consideration of the construction problem involved in road building. J. H. Cranford, President of American Cranford Paving Company, will preside at this session, and six papers will be presented. The first three of these deal with the "Haulage Methods in Highway Construction." "Industrial Railways" will be the subject of the paper by A. J. Parrish, while Charles H. Fry will talk on "Heavy Truck Haulage." "Light Truck Haulage" will be discussed by A. E. Horst.

Where freight rates have put a penalty on the use of commercially produced gravel and local gravel deposits are available large savings have resulted by equipping and operating local pits. In Wisconsin more of this local pit development for road construction exists perhaps than in any other state and what has been learned here of the plant and methods best suited to these small production units is of high value. H. E. Kuelling, construction engineer of the Wisconsin Highway Commission will tell of such saving within his state in his paper on "How to Equip and Operate Local Gravel Pits to Produce Concrete Aggregate."

Lost time cuts the road building season to about 100 working days each year and an investigation of these delays and of means by which they can be reduced is one of the most economic tasks before highway officials. In Iowa, very comprehensive studies have been made of the extent of these delays and a review of these studies will be presented by H. K. Davis, Chief Inspector, Iowa Highway Commission, in a paper on "How Much Time is Lost in Delays in Highway Building." In line with this matter of construction delays due to weather conditions and mismanagement, is the question of winter idleness and a paper on the possibilities of winter construction will be presented by John H. Mullen, Chief Engineer, Minnesota Highway Department. In Mr. Mullen's paper, "What Road

Building Work can be Done in Winter?" some astonishing accomplishments in gravel surfacing in winter will be presented.

Session on Maintenance

Highway maintenance is fully as important a topic as highway design and construction and the Thursday morning session of the convention will accordingly be devoted to this subject. A. R. Hirst, State Highway Engineer of Wisconsin will preside and an inspiring list of papers will be presented. In North Carolina a new state road system of 5,500 miles was put under intensive maintenance in eighteen months, and Frank Page, Chairman, North Carolina Highway Commission, will tell how it was done. Wisconsin has in four years perfected patrol maintenance to a remarkable state of efficiency and J. T. Donaghy, Maintenance Engineer, Wisconsin Highway Commission, will describe the equipment, organization, methods and results. Michigan has hundreds of miles of the finest gravel roads in the United States because of good maintenance and L. H. Nielson, Deputy State Highway Commissioner will describe Michigan gravel road maintenance practices. What Michigan has done with gravel roads Iowa has done with dirt roads through systematized block grades and road drag operations, and W. H. Root, maintenance engineer of that state will give the details of how it was done. The salvaging and maintenance of the thousands of miles of macadam roads in the east will be discussed by W. A. Van Duzer and A. W. Muir, maintenance engineers in Pennsylvania and New Jersey.

Session on Traffic

The session on Thursday afternoon will be devoted to the consideration of traffic problems and will be presided over by Thomas J. Wasser, President of American Road Builders' Association and State Highway Engineer of New Jersey. Where states have exceptional scenic attractions, hunting, fishing or other inducements to the vacationist and sportsman, they can be made a vast income producer to the state by proper development of highways. In Wisconsin the highway department cultivates tourist traffic assiduously and it is reaping an immense income for the state by so doing. In a paper "Tourist Traffic as a Factor in Highway Development" by A. R. Hirst, State Highway Engineer of Wisconsin, the method followed in this work will be presented.

Perhaps no question of highway policy concerns so many road officials or is so puzzling to decide as motor vehicles regulation and license fees. Truck loads, taxes on vehicles and gasoline, speeds and a score of other factors make the problem highly complex. In his paper on "Changes Needed in Motor Vehicle Legislation and License Fees," J. N. Mackall, Commissioner of Roads, Baltimore, Maryland, will tell how the problem has been solved in his state.

Congress Hotel and Annex, Chicago, Ill., Headquarters of the Thirteenth American Good Roads Congress

Session of Finance and Miscellaneous

The final technical session of the Congress will be held on Friday morning and will be presided over by Frank Page, Highway Commissioner of North Carolina. Three papers will be presented—the first by S. E. Bradt, former Superintendent of Highways of Illinois, on "Have Large Expenditures Changed the Public Attitude Toward Highway Development?", the second by L. C. Herrick, Director of Highways and Public Works, Columbus, Ohio, on "Co-Operation Between State and County Highway Departmnts," and the third by W. K. Hatt, Director, Highway Research Committee, National Research Council, Washington, D. C., on "How Individual Organizations Can Fit Their Work Into the Broad Highway Research Program."

F. E. EVERETT
Vice-Pres., Northeastern Dist.
State Highway Commissioner
Concord, N. H.

FRANK PAGE
Vice-Pres. Southern Dist.
Chairman, North Carolina
State Highway Commission
Raleigh, N. C.

J. FRANK SMITH
Vice-Pses.. Central Dist.
Manager, Good Roads Association of Greater Kansas City,
Kansas City, Mo.

SAMUEL HILL
Vice-Pres., Western Dist.
Hon. Life President, Washington State Good Roads Association, Seattle, Wash.

H. E. BREED
Consulting Highway Engineer,
New York, N. Y.

A. H. BLANCHARD
Prof. of Highway Engineering
and Highway Transport
University of Michigan
Ann Arbor, Mich.

G. P. COLEMAN
State Highway Commissioner,
Richmond, Va.

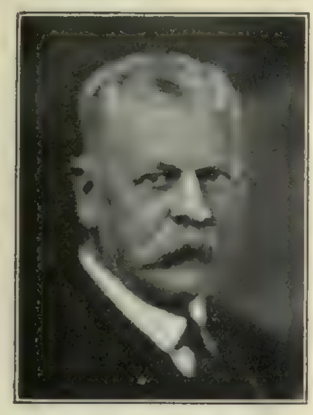
M. J. FAHERTY
President, Board of Local Improvements
Chicago, Ill.

H. L. BOWLBY
Chief, War Material Division,
U. S. Bureau of Public Roads,
Washington, D. C.

S. E. BRADT
Former State Superintendent
of Highways of Illinois,
De Kalb Ill.

FRED. E. ELLIS
Road Builder
Melrose, Mass.

Some Vice-Presidents and Directors of the


R. A. MEEKER
Right of Way Engineer, State Highway Department, Trenton, N. J

GEORGE W. TILLSON
Consulting Engineer
La Grange, Ill.

J. H. CRANFORD
Pres. The Cranford Paving Co.
Washington, D. C.

AUSTIN B. FLETCHER
State Highway Engineer
Sacramento, Cal.

W. A. McLEAN
Deputy Minister of Highways
Province of Ontario, Toronto, Ont., Canada

I. W. PATTERSON
Chief Engineer, State Board of Public Roads, Providence, R. I.

WM. R. SMITH
President, Lane Construction Corp., Meriden, Conn.

W. G. SUCRO
Engineering-Contracting
563 Calvert Bldg.
Baltimore, Md.

H. K. BISHOP
General Inspector, Bureau of Pub. Roads, Washington, D. C.

M. F. BRAMLEY
President, Cleveland Trinidad Paving Co., Cleveland, O.

CHAS. M. UPHAM
State Highway Engineer
Raleigh, N. C.

American Road Builders' Association, 1922-1923

The Fourteenth National Good Roads Show

Exhibition of Road Building Machinery and Materials Under Auspices of American Road Builders Association Will Be Held in Chicago Coliseum

THE fourteenth national Good Roads Show which opens next Monday at the Coliseum in Chicago in connection with the thirteenth National Good Roads Congress promises to surpass in both number and variety of exhibits all shows heretofore held.

As in previous years the Fourteenth Good Roads Show will include displays of every kind and type of road building equipment, machinery and materials. In addition many new inventions and improvements that have been developed during the past year will be displayed for the first time. In fact, so great has become the numbers of exhibitors and their demands for space that it was necessary in planning for this year's show to allot the entire space of the Coliseum and its adjoining buildings exclusively for show purposes and to hold the technical sessions of the convention, which have heretofore been held in the same building, in the Congress Hotel. Every foot of the 40,000 available in the Coliseum and Annex has been taken and in order that all who applied might have space it was necessary to reduce the amount allowed to each exhibitor. This extraordinary demand for space is not only due to increased requirement on the part of those who have regularly exhibited at the Road Show for many years, but to the many firms which previously have not displayed their equipment at the National Good Roads Show will be represented this year for the first time. Contractors and road builders who contemplate purchasing new materials, equipment or appliances, cannot well afford therefore to forego a personal inspection of the many remarkable exhibits at the Coliseum.

Greetings from Secretary Powers

E. L. POWERS

Secretary of American Road Builders' Association, 1922-23

MANY big things like the proverbial acorn start from small beginnings. This seems especially true of the GOOD ROADS SHOW, *the first one of which was held under the auspices of the American Roads Builders' Association at Columbus, Ohio, in 1909. I well remember the event. It took place in the fall of the year at the State Fair Grounds and was largely a demonstration in macadam highway construction just outside the grounds. The subgrade was prepared, the rock crushed on the spot, hauled on and rolled down. This proved to be one of the specially attractive features, the process being carefully watched by the delegates and local citizens. Spaces for the display of machinery and materials were assigned exhibitors in the Fair Buildings.*

When we compare our maiden efforts with what will take place at the forthcoming Good Roads Show to be held in Chicago we can realize something of the great growth of the road building industry in this country. Then the appropriations for highway equipment were small and the number of manufacturers of equipment was limited. The infant industry has since grown and it now takes its place among the foremost industries of the country. The conventions and exhibitions held by the American Road Builders' Association have kept pace with this growth and those who are fortunate enouhgugh to attend this growth and those who are fortunate enough to attend road building machinery, materials and methods that the world has ever seen.

E. L. POWERS.

The show will open on Monday evening, January 15th, at eight o'clock, and will be open every morning thereafter at nine o'clock and close at nine in the evening, except on Friday, the nineteenth. On this evening the exhibition's final closing will be at one P. M.

Floor plans showing the exhibition space on both the main and second floors of the Coliseum and Annex will be found on the following page while there follows immediately below a list of the exhibitors and addresses of their home offices as well as key numbers showing the location of their exhibits.

In addition to the exhibits by commercial concerns the Good Roads Show will feature a special exhibition by the U. S. Bureau of Public Roads. More than 2,000 feet of space are required for this exhibit which will take the form of large models showing the type of road the Bureau is building in its national forests. The model is 20 ft. in length and will represent a section of the highway in a typical mountain region. As a setting to the model a large oil painting will be displayed and so cleverly have the artists merged the two that when viewed from a distance they will blend together and greatly add to the realism of the scene. Many smaller models showing roads of various types in courses of construction will be displayed. Special testing apparatus developed by the federal engineers will also be on view.

In addition to this special exhibit of the U. S. Bureau of Public Roads, the Asphalt Association, Portland Cement Association, National Association of Paved Brick Manufacturers and many other similar organizations will display and demonstrate the latest methods which have been evolved for the laying and construction of the various types of pavements which they advocate.

Taken in its entirety the Fourteenth Good Roads Show will therefore be the most complete highway exhibit ever staged by any organization and taken in connection with the Good Roads Congress it will mark a distinct step forward in the purposes and accomplishments of the American Road Builders Association to make the Good Roads Show an event of national importance in its economic, educational and industrial phases.

List of Exhibits at 1923 Good Roads Show

COLISEUM

Adams & Co., J. K., 217 S. Belmont Ave., Indianapolis, Ind.	235-236
Aldrich Pump Co., The, 1936 McCormick Bldg., Chicago, Ill.	215½
American Casting Company, Box 591, Birmingham, Ala.	232-233
American Cement Machine Company, Keokuk, Ia.	102
American Road Builders Association, 37 W. 39th St., N. Y. C.	82-85
Archer Iron Works, 34th Pl. and Western Ave., Chicago, Ill.	166-186
Austin Mfg. Company, 400 N. Michigan Ave., Chicago, Ill.	112-113

Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill.	107-108
Automotive Utilities Corp., 914 Detroit Savings Bldg., Detroit, Mich.	105-129
Bacon, Edward R. Co., 51 Minna St., San Francisco, Cal.	231
Baker Mfg. Co., The, Springfield, Ill.	152-157
Barber-Greene Co., Aurora, Ill.	9-26-27
Barnes Mfg. Co., The, Mansfield, Ohio	201-202
Barrett Company, The, 40 Rector St., N. Y. C.	223-224-225
Bates Engine & Tractor Co., Joliet, Ill.	164-184
Beach Mfg. Co., Charlotte, Mich.	199-200
Bear Tractors, Inc., 53 Park Pl., N. Y. C.	194-195
Best, C. L. Tractor Co., 309 Woodward Ave., Detroit, Mich.	1-2-3-17-18-19
Blaw-Knox Company, P. O. Box 915, Pittsburgh, Pa.	83-84-85-86
Brookville Truck & Tractor Co., 605 S. Dearborn St., Chicago, Ill.	213
Brown Hoisting Machinery Co., 4403 St. Clair Ave., Cleveland, O.	90-91-92
Bucyrus Company, South Milwaukee, Wis.	78-79-80-81
Buda Company, The, Harvey, Ill.	205-206
Byers Machine Co., The, Ravenna, O.	75-76-77-51-52-53
Central States Engineering & Sales Co., 17 N. LaSalle St., Chicago, Ill.	174-175
Chain Belt Co., 734 Park St., Milwaukee, Wis.	42-43-44-45-46-66-67-68-69-70
C. H. & E. Mfg. Co., 254 Mineral St., Milwaukee, Wis.	209-210
Climax Engineering Co., 18th Ave. and 4th St., Clinton, Iowa	237
Clyde Iron Works Sales Co., 29th Ave. W. and Michigan St., Duluth, Minn.	173
Cropp, B. M. Co., 2334 W. Kinzie St., Chicago, Ill.	155-156
Domestic Engine & Pump Co., Inc., N. Queen St., Shippensburg, Pa.	207-208
Dunn Road Machinery Company, Conneaut, O.	103-127
Dunn Wire Cut Lug Brick Co., The, Conneaut, O.	104-128
Easton Car & Construction Co., 50 Church St., N. Y. C.	229-230
Electric Wheel Co., Quincy, Ill.	228
Erie Steam Shovel Co., 1540 Manadnock Bldg., Chicago, Ill.	54-55-56
Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.	161-181
Fate-Root-Heath Company, The, Plymouth, O.	191-192-193
Fuller-Crawler Co., The, 500 Clinton St., Milwaukee, Wis.	205½
Good Roads Machinery Co., 1203 Tower Bldg., Chicago, Ill.	5-6-7-21-22-23
Hadfield-Penfield Steel Co., The, Bucyrus, O.	41-65
Haiss, George Mfg. Co., Inc., 141st St. and Rider Ave., N. Y. C.	163-183
Hetzel Steel Form & Iron Co., The, Warren, O.	214-215
Holt Manufacturing Co., The, Peoria, Ill.	167-168-169-170-187-188-189-190
Hvass, Chas. & Co., Inc., 511 E. 18th St., N. Y. C.	93-94-95
Ingersoll-Rand Co., 11 Broadway, N. Y. C.	196-197-198
International Clay Machinery Co., 460 Monadnock Bldg., Chicago, Ill.	57
Koehring Company, Milwaukee, Wis.	115-116-117-118-119-120-121-139-140-141-142-143-144-145
Koppel Industrial Car & Equip. Co., Koppel, Pa.	178-179
Lakewood Engineering Co., The, Cleveland, O.	13-14-15-16-31-32-33-34
Le Roi Co., 60th and Mitchell Sts., Milwaukee, Wis.	203
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill.	10-11-12-28-29-30
Maxon Co., The, 27 Mack Block, Milwaukee, Wis.	8-24-25
Mead-Morrison Mfg. Co., Monadnock Bldg., Chicago, Ill.	180
Metal Forms Corporation, 1440 Booth St., Milwaukee, Wis.	216-216½
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.	59-60-35-36
Minneapolis Steel & Mach'y Co., 2854 Minnehaha Ave., Minneapolis, Minn.	151-171
Moore Bros., 39 S. LaSalle St., Chicago, Ill.	87-88-89
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.	47-48-49-50-71-72-73-74
Novo Engine Co., Lansing, Mich.	211-212-212½
O. K. Clutch & Mach'y Co., Columbia, Penn.	209½
Osgood Company, The, Marion O.	226-227
Owen Bucket Co., The, 458 Kirby Bldg., Cleveland, O.	160
Parsons Company, The, 11 S. LaSalle St., Chicago, Ill.	165-185
Pawling & Harnischfeger Co., 1640 Monadnock Bldg., Chicago, Ill.	96-97-98
Ransome Concrete Mach'y Co., 1325 Old Colony Bldg., Chicago, Ill.	146-147-148-149-150-122-123-124-125-126
Rennolds Equipment Co., 11 S. LaSalle St., Chicago, Ill.	204½
Russell Grader Mfg. Co., 2037 University Ave., S. E. Minneapolis, Minn.	99-100-101
Safety Traffic Light Mfg. Co., 425 East Water St., Milwaukee, Wis.	162-182
Sauerman Bros., 53 W. Jackson Blvd., Chicago, Ill.	218-219-220-221-222
Schramm, Inc., West Chester, Penn.	217
Seaverns, James B., 122 S. Michigan Ave., Chicago, Ill.	153-154
Smith Engineering Works, 330 Old Colony Bldg., Chicago, Ill.	213½
Smith, T. L. Co., The, 1125 32nd St., Milwaukee, Wis.	37-38-39-40-61-62-63-64

OFFICIAL HEADQUARTERS AND REGISTRATION BOOTHS

The official headquarters of the American Road Builders' Association will be at the Congress Hotel, Michigan Avenue and Congress Street. Officers of the association and the congress will be registered at this hotel and can be reached through the association headquarters.

Registration and information booths will be provided, however, at both the Congress Hotel and at the Coliseum. Upon presentation of tickets or passes at these booths and registration by delegates and visitors, badges and programs will be issued. For admission to the Coliseum passes should be presented at the main entrance on Wabash Avenue. Three distinct badges have been provided, one for officers of the American Road Builders' Association, one for members of the American Road Builders' Association, and one for delegates and visitors. Special badges will be issued to members of committees having in charge various phases of the convention work.

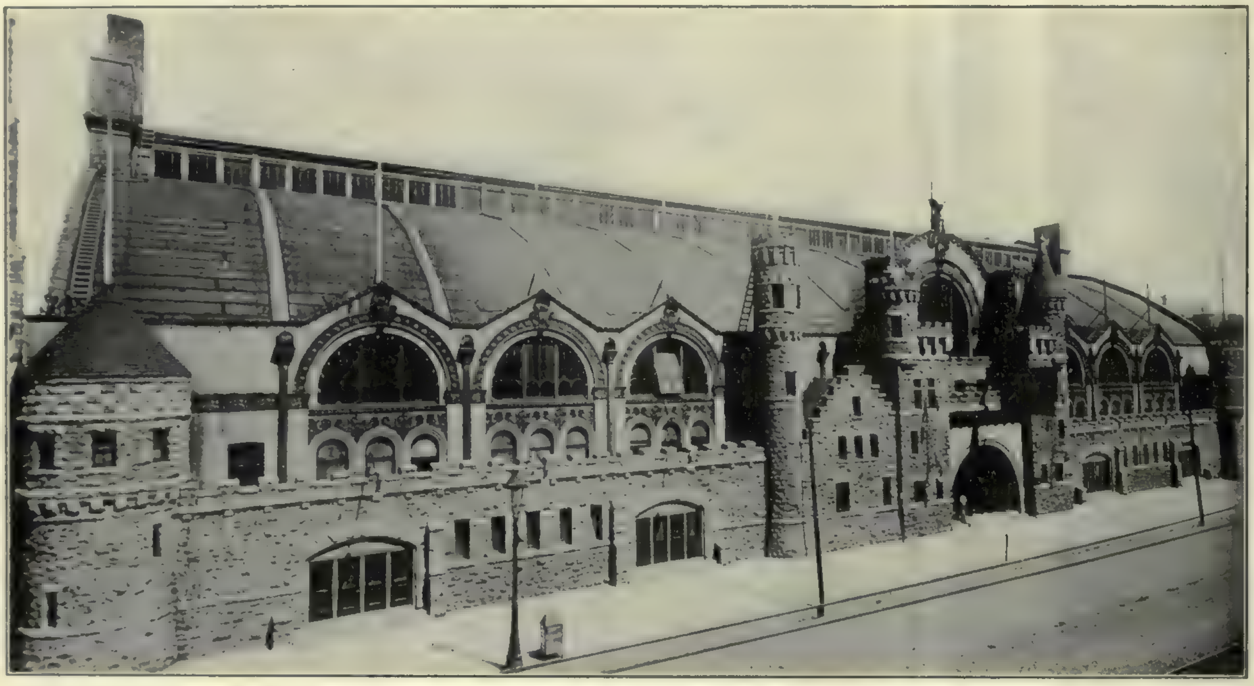
Stover Mfg. & Engine Co., Freeport, Ill.	208½
Sullivan Machinery Co., 130 S. Michigan Ave., Chicago, Ill.	4-20
Thomas Elevator Co., 20 S. Hoyne Ave., Chicago, Ill.	155-177
Waukesha Motor Co., Waukesha, Wis.	158-159
Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, O.	176
Western Wheeled Scraper Co., Aurora, Ill.	106-130
Whitcomb, Geo. D. Co., Rochelle, Ill.	234
Wisconsin Motor Mfg. Co., 44th Ave. and Burnham St., Milwaukee, Wis.	204

ANNEX

American Production & Trading Co., 4801 S. Morgan St., Chicago, Ill.	244
Anthony Co., Inc., Streator, Ill.	283-284-285
Mack Trucks, 1808 S. Michigan Ave., Chicago, Ill.	256-257-258-268-269-270
Sterling Motor Truck Co., Milwaukee, Wis.	274-275-276
Titan Truck Co., Foot of 25th St., Miwaukee, Wis.	246
Wood Hydraulic Hoist & Body Co., 3751 Wentworth Ave., Chicago, Ill.	238

GREER BUILDING

Austin Machinery Corp., 80 E. Jackson Blvd., Chicago, Ill.	14-15-16-17
Avery Co., Peoria, Ill.	22-23-24
Construction Machinery Co., Box "M," Sta. "A," Waterloo, Ia.	19



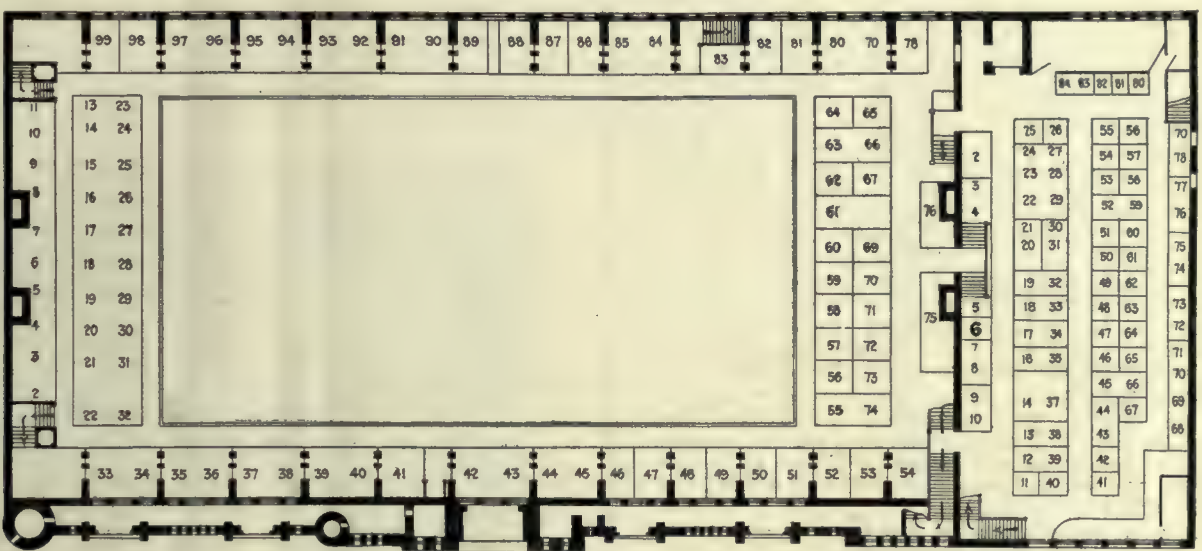
Chicago Coliseum, Where 1923 Good Roads Show Will Be Held

Autocar, 913-925 W. Jackson Blvd., Chicago, Ill.	205-251-252-262-263-264
Birg & Beck Co., The, Moline, Illinois	245
Federal Motor Truck Co., Detroit, Mich.	253-254-255-265-266-267
Four Wheel Drive Auto Company, Clintonville, Wis.	242-243
General Motors Truck Co., Pontiac, Mich.	247-248-249-259-260-261
Greer, Erwin, Automobile Co., 2437 S. Michigan Ave., Chicago, Ill.	280-281-282
Heil Co., The, Milwaukee, Wis.	277-278-279
Highland Body Mfg. Co., The, Elmwood Pl., Cincinnati, O.	241
Highway Trailer Co., Edgerton, Wis.	271-271½
Hug Co., The, Highland, Ill.	239-240
Indiana Truck Corporation, Marion, Indiana	272-273
Foote Concrete Machinery Co., 1241 S. Michigan Ave., Chicago, Ill.	9-10-11-12-13
French & Co., A. W., 208 N. Clinton St., Chicago, Ill.	20-21
Kelly-Springfield Motor Truck Co., 2630 S. Wabash Ave., Chicago, Ill.	4-5
Kinney Mfg. Co., The, 3529 Washington St., Boston, Mass.	30-31-32
Marsh-Carpon Co., The, 11 S. LaSalle St., Chicago, Ill.	28-29
Monarch Tractors, Inc., Watertown, Wis.	6-7-8
New Moline Plow Co., Tractor Works, Rock Island, Ill.	26-27
O'Connell Motor Truck Co., 1452 Michigan Ave., Chicago, Ill.	32½
Shaw-Enochs Tractor Co., 2416 University Ave., S. E. Minneapolis, Minn.	1-2-3

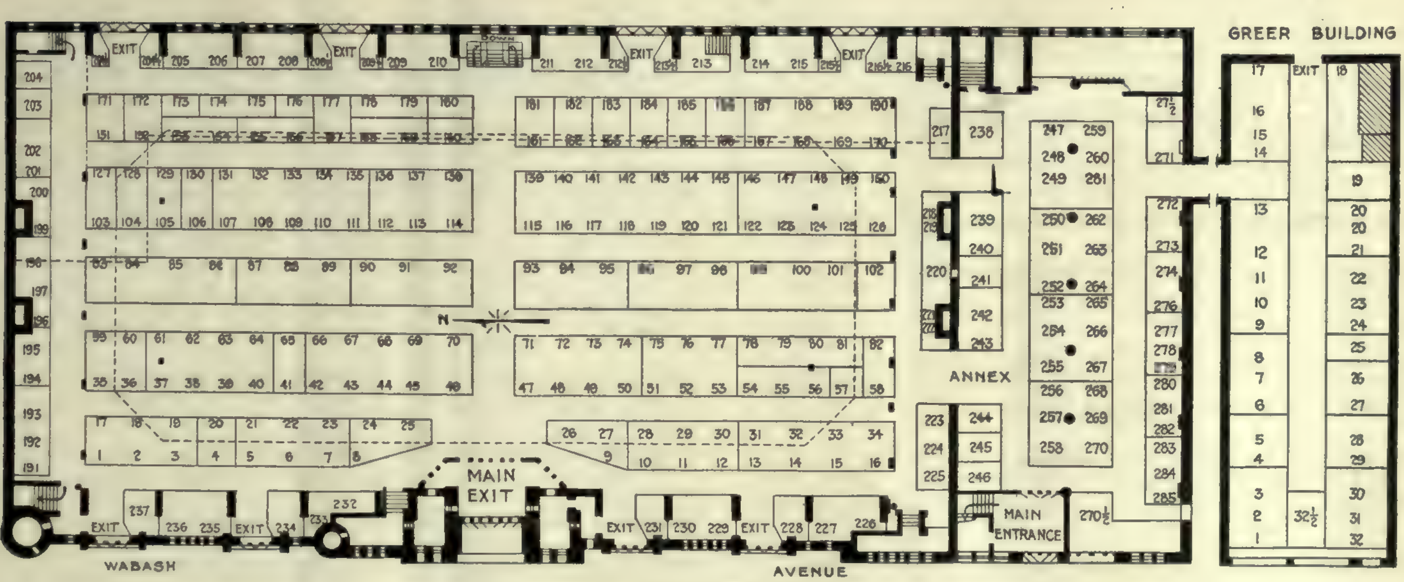
Watson Products Corp., Canastota, N. Y.	25
Wehr Co., 533 30th St., Milwaukee, Wis.	18

BALL ROOM

"American City," The, 443 4th Ave., N. Y. C.	55
American Manganese Steel Co., Chicago Heights, Ill.	52-59
American Steel & Wire Co., 208 S. LaSalle St., Chicago, Ill.	18-53
American Tar Products Co., 208 S. LaSalle St., Chicago, Ill.	7-8
American Vibrolithic Corporation, 623 Securities Bldg., Des Moines, Ia.	19-32
American Wood Preservers' Assn., 1146 Otis Bldg., Chicago, Ill.	82
Egyptian Iron Works, Murphysboro, Ill.	60
Etnyre, E. D. & Co., 2nd and Jefferson Sts., Oregon, Ill.	68-69
Farasay, J. D. Mfg. Co., The, E. 37th and Erie R. R., Cleveland, O.	57
Fairbanks Steam Shovel Co., The, 219 Leader St., Marion, O.	53
Freeman Mfg. Co., Racine, Wis.	65
Godwin, W. S. Co., Inc., 12 E. Lexington St., Baltimore, Md.	78-79
"Good Roads," 461 8th Ave., N. Y. C.	6
Gray Tractor Co., Inc., Minneapolis, Minn.	62
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.	46



Gallery Plan



Floor Plan

FLOOR PLANS CHICAGO COLISEUM AND ANNEX

Barber Asphalt Co., The, Land Title Bldg., Philadelphia, Pa.	13-38
Beaver Mfg. Co., Milwaukee, Wis.	56
Black & Decker Mfg. Co., Baltimore, Md.	72-73
Butler Equipment Co., 15 Wisconsin Ave., Waukesha, Wis.	64
"Engineering & Contracting," 9 S. Clinton St., Chicago, Ill.	25
"Engineering News-Record," 10th Ave. and 36th St., N. Y. C.	11
Headley Good Roads Co., 409 Monadnock Bldg., Chicago, Ill.	74-75
"Highway Builder," 203 N. 3rd St., Harrisburg, Pa.	26
Hastings Pavement Co., 25 Broad St., N. Y. C.	20-21
International Trade Press, Inc., 542 Monadnock Bldg., Chicago, Ill.	83-84
Kentucky Rock Asphalt Co., 711 Marion E. Taylor Bldg., Louisville, Ky.	49

SPECIAL REDUCED RAILROAD RATES TO DELEGATES ATTENDING GOOD ROADS CONGRESS

The Central, Trunk Line, Western, South-Western, South-Eastern, Canadian, New England and all other passenger associations have granted a special reduced rate under the "Certificate Plan" of one and one-half fares for the round trip, covering all points in their territory to and from Chicago. The reduced fare is not only available for members of the American Road Builders' Association and delegates to the congress but for dependent members of their families. In order, however, that they may profit by the reduced fare, delegates must carry out the following directions:

1. Be sure when purchasing your going ticket to ask the ticket agent for a certificate. If, however, it is impossible to get a certificate from the local ticket agent, a receipt will be satisfactory. It should be secured at the time the ticket is purchased. See that the ticket reads to the point where the convention is to be held and no other. See that your certificate is stamped with the same date as your ticket. Sign your name to the certificate or receipt in ink. Show this to the ticket agent.

2. Ask your home station whether you can procure through tickets to the place of meeting. If not, buy a local ticket to the nearest point where a certificate and through ticket to place of meeting can be purchased.

3. Immediately on your arrival at the meeting, present your certificate to the endorsing officer, E. L. Powers, Secretary, as the reduced fare for the return journey will not apply unless you are properly identified as provided for by the certificate.

4. A Joint Agent of the carriers will be in attendance during the convention week to validate certificates. If you arrive at the meeting and leave for home prior to the arrival of the Joint Agent, or if you arrive at the meeting after the Joint Agent has gone, you cannot have your certificate validated, nor secure the benefit of the return reduction.

No refund of fare will be made on account of failure either to obtain a proper certificate, or on account of failure to have the certificate validated.

Keystone Driller Co., 426 Monadnock Bldg., Chicago, Ill.	47
Koehring Co., Milwaukee, Wis.	1-2
Lewis, F. J. Mfg. Co., 2500 S. Robey St., Chicago, Ill.	54
Lufkin Rule Co., The, Saginaw, Mich.	50
"Municipal & County Engineering," 702 Wulsin Bldg., Indianapolis, Ind.	81
Mushroom Traffic Light, 317 Jefferson St., Peoria, Ill.	41
National Pavements Corp., 60 Broadway, N. Y. C.	16-36
National Paving Brick Mfrs. Assn., 830 Engineers Bldg., Cleveland O.	45-66
National Steel Fabric Co., Union Arcade Bldg., Pittsburgh, Pa.	12-39
"Pit & Quarry," 538 S. Clark St., Chicago, Ill.	5
"Public Works" (Journal), 243 W. 39th St., N. Y. C.	40
Rock Products, 542 S. Dearborn St., Chicago, Ill.	58
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago, Ill.	9-10
Stroud & Co., Omaha, Nebraska	42
Taylor-Wharton Iron & Steel Co., 208 S. LaSalle St., Chicago, Ill.	61
Thew Shovel Co., The, Lorain, O.	17-34
Truscon Steel Company, Youngstown, O.	14-15-36-37
Union Iron Products Co., E. Chicago, Indiana	63
Warren Brothers Co., 9 Cambridge St., Boston, Mass.	43-44
White, David Co., Inc., 915 Chestnut St., Wilwaukee, Wis.	48
Wyoming Shovel Works, The, Wyoming, Pa.	3-4

BALCONY

Acme Road Machinery Co., Frankford, N. Y.	55-74
A. R. B. A., Registration	90-91
A. R. B. A., Ticket Validation	42-43
American Willite Co., 716 Free Press Bldg., Detroit, Mich.	71
Asphalt Association, The, 25 W. 43rd St., N. Y. C.	58
Asphalt Products Co., Tioga and Memphis Sts., Philadelphia, Pa.	88
Bain Wagon Co., The, Kenosha, Wis.	47
Burch Plow Works, The, Crestline, O.	89
Carbic Mfg. Co., 565 W. Washington St., Chicago, Ill.	60
Carey, The Philip Co., Locliand, Cincinnati, O.	53
Clay Products Association, 133 W. Washington St., Chicago, Ill.	79-80
Concrete Steel Co., 42 Broadway, N. Y. C.	63-66
Corrugated Bar Co., Inc., 20 W. Jackson Blvd., Chicago, Ill.	69
Cummer, F. D. & Son Co., 1150 Hanna Bldg., Cleveland, O.	65
Dee, Wm. E. Company, 30 N. LaSalle St., Chicago, Ill.	62
East Iron & Machine Co., E. Market St., Lima, O.	49
Equipment Corporation of America, Lumber Ex. Bldg., Chicago, Ill.	87
Erie Steel Construction Co., The, Erie, Penn.	52
Granite Paving Block Mfrs. Assn. of U. S., Boston, Mass.	59
Green, L. P., 11 S. LaSalle St., Chicago, Ill.	75
Grasselli Powder Co., The, 1617 Fisher Bldg., Chicago, Ill.	83
Handy Sack Baler Co., 631 S. 2nd St., E. Cedar Rapids, Chicago, Ill.	70
Mich.	70
Hercules Corporation, The, Evansville, Indiana	78
International Steel Tie Co., The, 16702 Waterloo Rd., Cleveland, O.	81
Jaeger Machine Co., The, 520 Dublin Ave., Columbus, O.	61-68
"Manufacturers Record," Commerce and Water Sts., Baltimore, Md.	67
Overman Cushion Tire Co., 608 S. Dearborn St., Chicago, Ill.	64
Partridge, Singer & Balwin, Inc., 44 Whitehall St., N. Y. C.	77
Pittsburgh Testing Laboratory, 7th and Bedford Ave., Pittsburgh, Penn.	51
Public Roads, Bureau of	2-32 inc.
Sivver Steel Castings Co., 37th and Mitchell, Milwaukee, Wis.	57
State Highway Commissions	92-99 inc. 33-41 inc.
Stockland Road Mach'y Co., 34th Ave. S. and 27th St., Minneapolis, Minn.	84-85
Thompson Bros. Co., Inc., 1806 Michigan Ave., Chicago, Ill.	54
Topping, Chas. T. Machinery Co., Pittsburgh, Pa.	82
Wiard Plow Company, Batavia, N. Y.	73

Special Entertainment Features of the Show and Convention

IN addition to its technical sessions at the Congress Hotel and the Good Roads Show at the Coliseum, an entertainment program has been prepared for the Thirteenth American Good Roads Congress which will appeal to all who attend. The week's program will include a stag party given by the exhibitors on Tuesday night, January 16th, at the Morrison Hotel. Music, songs, dances and boxing contests have been prepared for the party, which will start at eight-thirty o'clock and close at eleven. A theatre party has been arranged for the ladies attending the convention on this same evening.

On Wednesday evening, January 17th, the annual banquet of the American Road Builder's Association will take place in the Elizabethan Room of the Hotel Congress. James H. MacDonald, Treasurer of the Association, will act as toastmaster, and included among the speakers will be Bainbridge Colby, former Secretary of State during the Wilson administration, Claude N. Sapp, former Assistant Attorney General of South Carolina, and W. H. Malone, Chairman of the Illinois State Board of Taxation. A musical and vaudeville program has also been planned for this evening.

ELIZABETHAN ROOM OF THE CONGRESS HOTEL, IN WHICH ANNUAL BANQUET WILL BE HELD

On Thursday evening, January 18th, the American Road Builders' Association will entertain the delegates and visitors at Terrace Gardens. Dinner will be served at six-thirty, followed by a show and dance.

In addition to these special events planned by the Convention Committee, Chicago itself will offer many attractions, as it is unsurpassed as a convention centre. With numerous theatres and restaurants, museums and galleries, Chicago entertainment advantages are among those of the leading cities in the world.

CONVENTION COMMITTEES FOR 1923 CONGRESS

Convention and Show Committee: C. M. Upham, Raleigh, N. C., Chairman; T. J. Wasser, Trenton, N. J.; S. F. Beatty, Chicago, Ill., and James H. MacDonald, New Haven, Conn.

Banquet Committee: J. R. Draney, New York City, Chairman; J. F. McGurk, Chicago, Ill., Vice-Chairman; I. J. Bransfield, Chicago, Ill.; A. J. Brehm, Cincinnati, O.; Frank B. Dunn, Conneaut, O.; William Howe, Chicago, Ill.; W. H. Kershaw, New York City; Claude King, Wilkes-Barre, Pa.; H. R. Kasson, Chicago, Ill.; Fred Lucke, Chicago, Ill.; Ed. Middleton, Chicago, Ill.; Charles Matteer, Chicago, Ill.; Robert McKay, Chicago, Ill.; W. J. Malatesta, Chicago, Ill.; W. H Malone, Chicago, Ill.; John P. McGarry, Chicago, Ill.; Grant Osborne, Chicago, Ill.; W. W. Platzer, Chicago, Ill.; H. A. Royer, Chicago, Ill.; A. C. Sullivan, Chicago, Ill.; John Sullivan, Chicago, Ill.; Dyer Sackley, Chicago, Ill.; Ernest Stocking, Chicago, Ill.; William Sinck, Chicago, Ill.; W. H. Stone, Baltimore, Md.; R. B. Tyler, Louisville, Ky.; M. E. White, Chicago, Ill.; Bertram H. Wait, New York City, and Roger Williams, Chicago, Ill.

Publicity Committee: S. T. Henry, New York City, Chairman; J. E. Pennybacker, New York City; C. R. Ege, Chicago. Ill.; M. O. Eldridge, Washington, D. C., and R. E. Brooks, New York City.

Entertainment Committee: A. C. Cronkrite, Chicago, Ill.; Chairman; A. A. Ackley, Chicago, Ill.; James A. Alder, Chicago, Ill.; Charles J. Bennett, Hartford, Conn. ;S. H. Bingham, Chicago, Ill.; F. P. Bowman, Chicago; J. P. Case, Chicago; R. B. Dickinson, Chicago; Thomas J. Hay, Chicago; J. L. Hecht, Chicago; U. J. Herrman, Chicago; G. E. Hillsman, Chicago; W. L. Hodgkins, Chicago; Samuel Irwin, Philadelphia; J. M. Kelley, Trenton, N. J.; E. J. Kilborn, Chicago; James Levy, Chicago; F. W. Lucke, Chicago; W. J. Malatesta, Chicago; J. J. McCarthy, Chicago; H. McKay, Chicago; E. L. Middleton, Chicago; A. C. O'Loughlin, Chicago; Grant Osborne, Chicago; R. B. Randall, Chicago; F. A. Reimer, Newark, N. J.; F. W. Renwick, Chicago; Henry Roper, Chicago; J. B. Sackley, Chicago; J. J. Sullivan, Chicago; L. N. Whitcraft, New York City; M. E. White, Chicago; F. V. Widger, Chicago, and M. J. Faherty, Chicago.

Reception and Hotel Committee: (Honorary Members). M. J. Faherty, Chicago; Charles C. Fitzmorris, Chicago; Clifford Older, Springfield, Ill.; C. R. Miller, Springfield, Ill.; George A. Quinlan, Chicago; Daniel Ryan, Chicago; Edward E. Gore, Chicago; John Bowman, Chicago; W. W. Baird, Chicago; Watson F. Blair, Chicago; W. E. Humphrey, Chicago; Homer Neize, Chicago; James C. Jeffrey, Chicago; A. M. Cornell, Chicago; Julius L. Hecht, Chicago; R. I. Randolph, Chicago; A. J. Hammond, Chicago; W. F. Lodge, Monticello, Ill.; Eugene R. Pike, Chicago; Christian C. Wiehe, Chicago; Si Mayer, Chicago; Herman Mack, Chicago; W. Frank McClure, Chicago; Charles M. Hayes, Chicago; (Active Members): R. F. Kelker, Chicago; K. A. McGuire, Chicago; Charles Wallace, Chicago; Harry A. Fox, Chicago; Barnard Dolan, hicago; W. H. Myers, Chicago; Fred W. Hansen, Chicago; William G. Coats, Chicago; F. W. Locke, Chicago; C. E. Mateer, Chicago, and J. E. Black, Chicago.

Registration Committee: Lewis S. Louer, Chicago, Chairman; Ezra W. Clark, Chicago, and Louis McLouth, Chicago.

Exhibitors' Committee: C. R. Ege, Chicago, Ill., Chairman; H. R. Snow, Chicago, Ill.; C. N. Leet, Milwaukee, Wis.

Chicago Press Committee: Wallace R. Harris, Chicago, Ill., Chairman; Louis McLouth, Chicago, Ill.; L. C. Murdock, Chicago, Ill.

Program Committee. E. J. Mehren, New York City, Chairman; C. S. Hill, New York City; L. C. Herrick, Columbus, O.; F. T. Sheets, Springfield, Ill.; H. H. Wilson, Muncie, Pa.

Transportation Committee: Royal N. Allen, Chicago, Ill., Chairman; J. L. Ferguson, Chicago, Ill.; John H. Cook, Chicago, Ill.

Director of Exhibits: C. W. Kelly, Chicago, Ill..

Director of Publicity: Clifford Spurrier Lee, New York City; Assistant, Walter A. Bermingham, Chicago, Ill.

New Filler Material Will Hide Joints in Concrete Pavements

Unsightly black lines, sometimes jagged and irregular, which mar the appearance of practically all concrete roads and which are due to the natural color of materials used to fill joints and cracks, will be avoided by the use of a material for the purpose developed in the laboratories of the U. S. Bureau of Public Roads, if tests by actual use prove as successful as expected. This material has the same color as concrete, and when used to fill cracks and joints the surface has the appearance of a continuous and unbroken slab to the casual observer.

The mixture consists of approximately 12 parts rosin, 1 part crude rubber, with sufficient barium sulphate to give the desired color. In preparation the rubber is dissolved in gasoline, and the rosin is then mixed in with an application of heat, the coloring material being added as required. Any desired consistency can be obtained by varying the proportions. A material with remarkable adhesive properties is produced and which can be heated so that it will flow into the cracks and joints.

Fire Prevention in Highway Bridges

During the past few years a number of fires have occurred on important bridges and the circumstances attending these fires have indicated the desirability of making a detailed study of the situation, in an attempt to bring out the important factors governing the fire hazard in timber bridge construction. With this purpose in mind a co-operative committee was formed representing fire protection, highway bridge construction, lumber, creosoting and the public interest. This committee consists of Geo. W. Booth, Chief Engineer, National Board of Fire Underwriters, Chairman; L. T. Ericson, Chief Engineer, The Jennison Wright Company; S. M. Taylor, Post President, American Wood Preserver's Association; D. F. Holtman, Construction Engineer, National Lumber Manufacturers' Association; C. J. Hogue, Manager, West Coast Forest Products Bureau; F. E. Schmitt, Associate Editor, Engineering News-Record, and E. F. Kelley, Senior Highway Bridge Engineer, U. S. Bureau of Public Roads. The Secretary carried on an extensive correspondence with city, county and state bridge engineers, and upon this and information collected from other available sources the following report is based.

THE existence of a fire risk in bridges having wooden floors must be recognized. An indication of the importance of this risk is the fact that on some heavily traveled city bridges small fires are of daily occurrence during the summer months[1]. The available evidence indicates that this risk is much less for country bridges than for city bridges and is greater on long bridges than on short ones. On city bridges, fires are most commonly caused by the lodgment of lighted cigar or cigarette stubs in cracks or depressions where chaff and debris have collected. Decayed or splintered material in the floor adds greatly to the fire risk. In the case of country bridges the greatest risk is from forest and grass fires. Other reported causes of fires are:

1. Sparks from locomotives or steamboats.
2. Hot coals dropped by steam rollers, traction engines, tar kettles or other construction equipment.
3. Burning waste dropped by street cars.
4. Defective insulation of electric wiring; defective bonding of rails and lack of capacity in return feed wires of electric railways.
5. Fires in adjacent structures.

Relation of Preservative Treatment to Fire Risk

Creosoted material appears to be somewhat more difficult to ignite than untreated material, but once ignited it creates a fire which is hotter and more difficult to control and which is known by experience to be more destructive than fire in an untreated floor. However, decayed or partially decayed untreated wood is very easily ignited and has been the cause of many fires. The likelihood of fire is increased by treatment which results in excessive bleeding of oil, such as might be caused by the heavy treatment of green lumber. It should be noted that freshly creosoted material is much more inflammable than that in which the treatment is several months old. It is urgently recommended that orders for creosoted material be placed as far as possible in advance of construction and that the material be seasoned for from three to six months after treatment.

Where it is practicable to do so, freshly treated timber may be rendered more fire resistant by thorougly coating the upper surface with sand. The application of sand should be continued as long as there is any bleeding of oil.

Importance of Construction

In general it may be stated that tightly laid floors, in which cracks are eliminated to a large extent, are most fire resistant[2]. The relative fire risk of various types of floor beginning with the most fire resistive may be stated as follows:

1. Wood blocks on concrete base. This type of floor may be said to have no fire risk.
2. Wood blocks on plank sub-floor.
3. Laminated floor of 4 in., 6 in. or 8 in., strips laid on edge and spiked together, with a bituminous wearing surface.
4. Plank floor with bituminous wearing surface.
5. Laminated floor without wearing surface.
6. Multiple thickness plank floor.
7. Single thickness plank floor.

Steel joists or stringers supporting floors of any of the above types reduce the risk of rapid spread of fire by reducing the amount of combustible material exposed. Where wood joists or stringers are used the fire risk will be reduced by using heavy timbers for these members. The massing of combustible material renders it less susceptible to ignition and the spread of fire and lessens the probability of serious structural damage before the fire can be controlled, in case fire-fighting means are at hand.

Special care should be exercised in the design of the floor and its supporting structure to avoid ledges or pockets in which trash may collect. The possibility of the accumulation of rubbish on truss members and in floor openings made for the passage of these members should be given careful consideration. In cases where such construction will not interfere with the proper disposal of floor drainage, curbs on timber floors should be constructed with ample clearance between curb and floor so that trash may have an opportunity to blow away.

To check the spread of fire lengthwise of the bridge the spaces between stringers, in cases where these rest on the floor beams, should be filled with tightly fitting diaphragms over each floor beam. Perhaps the most practicable method is to use wooden diaphragms at least 6 in. thick, which may be made up of two thicknesses of plank spiked together. Strips or battens should be placed around the edges of these diaphragms to cover cracks due to imperfect fitting or shrinkage.

In cases where limitation of headroom is not a factor,

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(1) Mr. John D. Stevenson, Assistant Chief Engineer of the City of Pittsburgh makes the following statement: "The City has several steel bridges having wooden floors. Some of these are large structures crossing the rivers and are important arteries of traffic. During the hot dry periods of the summer, fires on these bridges are very frequent. They are of minor importance only, because we have been successful in extinguishing them before the flames have taken much of a hold. During the last summer, on one bridge fires were a daily occurrence and not infrequently two or three fires occurred in one day."

The Annual Report of the Fire Commissioners of the City of Holyoke, Massachusetts, for the year 1921, states that during the year "the Department responded to 170 fires on the various bridges. The month of June was particularly prominent in this respect, when the Department responded to 64 alarms for bridge fires. This epidemic was lessened in the months to follow through the efforts of the Board of Public Works in sending the sprinkler over the county bridges frequently during the day. While the Department has been very fortunate in the past in extinguishing bridge fires at a minimum loss, there is always danger of such a blaze getting so much headway as to cause the loss of one of the bridges." In practically all cases, the cause of these fires is stated in the report of the Fire Commissioners to be cigarette stubs.

(2) Mr. Thomas J. Wasser, State Highway Engineer of New Jersey, states that prior to January, 1922, the old Raritan River bridge at Perth Amboy was decked with closely laid rough plank flooring and that, to his knowledge, no fires were reported during the life of that floor. The deck was replanked with heavier lumber, surfaced on two sides and one edge, and laid with ½-in. openings. Since that time there have been seven small fires on the bridge and it has been necessary for the Department to put on a fire patrol to meet these conditions.

fire curtains of sheet metal extending at least 5 ft. below the bottoms of the joists, and spaced at intervals of about 50 ft. will be of material assistance in preventing the spread of fire. The corrugated asbestos-covered metal as used for siding and roofing of buildings is suggested for this purpose.

Floors, ledges and pockets, and bridge seats should be kept free from street sweepings and other trash. In the case of country bridges, particularly timber trestles, all underbrush, small timber, drift and debris, underneath and for some distance on both sides of the bridge should be removed. Grass and weeds should be cut in the early fall and drift should be removed after floods. Where the vegetable growth is heavy, chemical weed killers are recommended as being economical and efficient. Frequent inspections should be made of any conductors of electricity which may exist on the bridge. Floors should be kept free from splintered and decayed wood.

For bridges where watchmen or bridge tenders are employed, water barrels, sand boxes or water mains may be employed to advantage for fighting fires. For bridges not under constant supervision the value of any of the above is questionable although sand boxes would probably be most likely to be ready for use when needed. Water barrels and sand boxes should be covered and the surface of the water in the barrels should be covered with a light film of oil. In cold climates freezing of the water in barrels can be prevented by the addition of a suitable amount of calcium chloride.

When water mains are provided they should have hose connections every 50 ft. and hose reels every 200 ft. In cold climates they must either be protected against freezing or be kept empty with provisions for supplying them with water under pressure, either from hydrants direct or from fire engines.

Watchmen and drawbridge tenders should be provided with at least one 2½ gal. soda-acid fire extinguisher. Where aid may be expected from a municipal fire department, there should be provided some means of transmitting alarms. If watchmen or bridge tenders are on duty, a telephone may be considered as a substitute for the more reliable and satisfactory public box on a fire alarm telegraph system.

Maintenance a Vital Factor

Maintenance of the under-structure and the use of fire fighting appliances will be facilitated by providing under the bridge floor, on each side of each pier and at intermediate points not more than 100 ft. apart, platforms constructed of fire resistive material. Access to these platforms may be secured either by hatchways in the bridge deck or by stairs on the outside of the bridge.
available, there should also be provided at 20 ft. intervals,

In cases where fire streams from hose and nozzles are both longitudinally and transversely, openings in the bridge to permit the use of cellar pipes, revolving nozzles or similar devices. These openings should be not less than 10 in. in diameter and should be provided with metal covers which can be easily removed but not readily displaced by accident.

The weight of the evidence,, obtained from laboratories which have investigated this subject, is to the effect that, whatever may be expected from future experimentation, there is at present little that can be accomplished in the way of rendering wood fire resistive by means of a paint coating or other treatment by chemical methods. A paint coating which is not readily combustible may, however, serve to delay slightly the time in which the lumber reaches its maximum susceptibility to ignition. The difficulty with the chemical treatment is that the chemicals will either wash out or, if waterproof, are not fire resistive.

The investigation having shown that the subject of bridge fire protection is of an importance not previously recognized, the committee desires to emphasize the need for giving consideration to the fire risk in the design of highway bridges. Public officials having bridges in their charge have a clear responsibility in the matter, and the commmittee desires to call to the attention of such authorities the desirability of protecting bridges by due care in design and construction, by watchful maintenance, and by provision for preventing and fighting fires.

A Concave Concrete Pavement

EXPERIMENTS of interest to highway engineers of the Northwest have been undertaken by S. H. Walker of the Walker-Weston company, 7 Wormwood street, E. C. 2, London, England. Mr. Walker proposes to make the under surface of the concrete slab, and also the surface of the road, slope down from the sides to the center, instead of cambering it in the usual way whereby the center is higher than the sides. He argues that if the slope is downwards from the sides to the center the concrete when it expands sideways under the influence of heat or moisture will have to do so uphill against the action of gravity, and when it contracts it will so to speak, pull itself together towards the center of the road. For a country arterial road having a roadway 30 feet wide or more he would make the formation slope downwards one in sixteen from the sides to a central level portion six feet wide.

The Times Engineering Supplement describing Mr. Walker's plan, says the formation would consist of a porous layer of ashes or clean gravel well rolled with a 10-ton roller and left with a perfectly smooth surface upon which the concrete slab would be able to slide freely, special care being taken to see that the bearing capacity is equal throughout. The concrete slabs would be perhaps 12 in. thick at the middle, but thinner at the sides. The concrete at the bottom would be composed of one part of cement to six parts of Thames ballast, or like mixture, and the surface layer, two in. thick, would consist of one part of cement to one and one-quarter of sand and three of two and one-half inch broken granite chips, and would be laid just before the bottom concrete had set. The slab would be reinforced by a double layer reinforcement weighing 12 pounds per square yard, and consisting of top and bottom layers of steel connected together to form a mattress by uniformly diagonal tension shear members. The surface would slope uniformly down to the center at one in 30 to one in 50. Such a slope, while ample for a clean surfaced road like concrete, would hardly be noticeable; but as the part of the road nearest the footpath would be the driest and the slope and character of the surface would be uniform, the slower horse traffice would naturally tend to keep close to the curb, thus remedying one of the causes of traffic congestion.

It is interesting to observe the curiously different viewpoint of the average man with regard to the use of public highways as compared with his ideas regarding the use of other forms of public property. Imagine the use of a room or corridor in a city hall, public school building or public library being pre-empted for the use of an individual citizen.

Why, then, is it not equally wrong to permit the pre-empting of a public highway by a vehicle of such huge dimensions that its use blocks the road to others who have an equal right to its use.

There has been some legislation with regard to vehicle loads. Why not also the regulation of vehicle size? —"Road Economies."

Current Events in the Field of Highway Engineering and Transport

Good Road Plans To Be Feature of Coming Session of Minnesota Legislature

Measures to Provide More Adequate Highways for 1923 and 1924 to Be Considered

Measures of immediate benefits to be gained from present outlays for better roads without any increase in taxation and of savings by automobile and truck owners of money which otherwise must go for extra gasoline, tires and car upkeep will be largely determined for the next two years by the Minnesota Legislature which opened its session in the capitol at St. Paul on January 2nd. Special interest centers in the highway legislative program, according to reports from all parts of the state.

Expressing complete confidence in the plain, good business policies to be urged by the highway department and in the judgment of both senate and house members, Charles M. Babcock, state highway commissioner, predicates favorable action on the good roads proposals.

"The legislators know the public demand for adequate highways," states Commissioner Babcock, "and the highway department will undertake to show that they can be built on a bigger scale for use now and that they will pay for themselves many times over. The proposals are so simple and plain that a 10- year-old school boy can see the wisdom of adopting them.

"The bond plan will lift the burden of paying in these times of high taxes the whole cost of road work which will serve for many years and will mean further reductions in road taxes. It will not make the past pay for roads which it should have built but it will pass on to each future year its fair share of the cost of highway improvement. All this will be without increasing taxes or net costs of better roads!"

The commissioner also points to the official record of nearly $1,300,000 decrease in road taxes the first year after the new program transferred to the state and from the counties the big expense of main, highway improvement and maintenance. It is additional evidence that the new plan is fulfilling every promise made for it and the purpose now is to obtain still greater and more immediate benefits from it.

"Legislative delegations from the three large cities looked with favor on the highway proposals at their preliminary meetings," says Commissioner Babcock, "and when the localities paying most and receiving the least directly from the trunk highway program take that attitude, there is more reason to expect the full support of members from the country districts.

"St. Paul and Ramsey county are to seek legislation for bond issues of nearly $7.000,000 for street and highway betterments, only a small part of which can bring state reimbursements. Minneapolis and Hennepin county also place high value on adequate roads for all Minnesota. Although only 70 miles of the 7.000-mile trunk highway system are within Hennepin county, it pays nearly one-fifth of the total motor vehicle taxes in the state. They pay six times as much state highway aid as they receive, and the difference of nearly $300,000 also is used on roads in other counties.

"Further, Hennepin county is transferring a part of its state aid to nearby counties and Minneapolis is helping privately to carry through other improvements on roads serving the city.

"The large centers taking that liberal stand," states Mr. Babcock, "the other parts of Minnesota cannot afford a don't-want-your-help attitude. Their members in the legislature when they correctly understand the plans will make the most of the present advantage, knowing that every dollar used on the trunk highways bring nearer the improvement of every part of the system. And that accomplished, Minnesota will go forward with a highway program which will attract national attention despite the bigger bond and other funds available in some states."

The highway commissioner repeated that once correctly understood, the highway proposals have claimed universal support and attributed to this his confidence that legislative action will be favorable.

ILLINOIS ADOPTS NEW DESIGN FOR CONCRETE ROADS

As a result of the tests made on the Bates Experimental Road, which were recently completed, a new cross-section design for concrete pavements has been made standard by the Illinois State Highway Department. This new cross-section provides for a thickness of 9 in. at the edges of the pavement tapering to 6 in. at a distance of 2 ft. from the edges. The remainder of the pavement is to have a uniform thickness of 6 in. and the amount and arrangement of reinforcement are to be the same as that hitherto used, with the exception of the center-joint material. A new design has been provided for the center joint to correspond with the new 6-in. center thickness.

PLAN PERMANENT HIGHWAYS ALONG MISSISSIPPI

A permanent highway along the Mississippi valley from St. Paul to La Crosse, Wis., is the object of an organization of representatives of commercial bodies in river towns, which had its beginning at a meeting attended by men from many cities in the district covered, which was held recently at the Chamber of Commerce rooms at Red Wing, Minn.

Each commercial organization is to have three representatives on the body, which will have as its sole object the boosting of State Highway No. 3, known as the Mississippi Scenic Highway, and the securing of state aid to put this road in first-class condition. It was pointed out that Road No. 3 is a transcontinental highway, being used by thousands of tourists each year. It is one of the most beautiful scenic highways to be found in America and if conditions for travel can be improved it will mean the coming of many thousands more travelers to this section.

Part of the road is in good shape. A section is paved near Winona and also near Red Wing. A new road has been built between Wabasha and Lake City and the section between Red Wing and Hastings is for the most part in excellent condition. From a point a little south of St. Paul to Hastings however, conditions are bad, as is the case between La Moille and La Crescent, a distance of about 17 miles.

COUNTRY SHOULD ALLOW FOR FUTURE TRAFFIC IN BUILDING ROADS, SAYS U. S. BUREAU OF PUBLIC ROADS

In building a road liberal allowance should be made for future increase in traffic, says the U. S. Bureau of Public Roads. A traffic count conducted by the bureau in co-operation with Tennessee officials on a number of roads in Davidson County, in which Nashville is located, shows surprising facts when compared with a simliar count in 1916. During this period automobile registrations have doubled, while the number of motor vehicles on the road is five times as great as in 1916. In 1916 horse-drawn and motor-vehicle traffic were almost equal in volume. In 1921 horse-drawn traffic had decreased only slightly in volume and constituted 16 per cent of the traffic, motor vehicles constituting 84 per cent.

Observations in this and other counties lead to the conclusion that volume of traffic may increase in much greater proportion than the number of motor vehicles and will also depend to a large degree on the condition of improvement of the road and on the economic conditions in the adjacent territory.

ILLINOIS COMPLETES PAVING ON IMPORTANT SECTION OF LINCOLN HIGHWAY

The State Highway Department of Illinois has completed the pavement of the Lincoln Highway between Plainfield and Joliet and the road is now open to travel.

Last year the Department completed the paving between Geneva and the Mississippi River, which together with the paving between Geneva and Chicago provided a trans-state paved road for those leaving the Illinois metropolis. However, there were some gaps in Lincoln Highway improvement between Geneva and the Indiana State line on the Lincoln Highway route proper, which does not enter Chicago. These gaps which totaled 28.8 miles of old macadam and dirt out of the total mileage across the State of 172.6 miles were located between Joliet and New Lenox. The section just completed between Plainfield and Joliet leaves for construction next year only a short gap in Will County near New Lenox and the section between Plainfield and Aurora where 11 miles of concrete will be laid during 1923 at an approximate cost of $300,000,00.

Clifford Older, State Highway Engineer of the Illinois Department of Public Works and Buildings, is confident that the season of 1923 will see the final pavement of all remaining gaps on the Lincoln Highway in his State which, in 1914, did not have one mile of paved road on the transcontinental route outside of municipal limits.

TEXAS HIGHWAY CONTRACTS TOTAL $2,000,000 DURING LAST THREE MONTHS

Approximately $2,000,000 worth of paving contracts have been let during October, November and December for construction of state highways between San Antonio and the Gulf Coast, according to T. R. Spence, division engineer of the State Highway Department, in charge of State District No. 6, in which San Antonio is located. Contracts let during the week of Dec. 22, called for construction of 25 miles of highway in Medina County, at a cost of $149,388.15; and building of two miles of road in Atacosa County, at a cost of $16,348.32. Completion of the Medina County construction will be followed by letting of contracts for placing rock asphalt topping, while completion of Atacosa County construction will be followed by letting of contracts for hard surfacing

U. S. BUREAU OF PUBLIC ROADS PLANS RURAL ENGINEERING RESEARCH

In the future the rural engineering division of the U. S. Bureau of Public Roads will concentrate its work on research problems. Heretofore the division has found it difficult to relinquish its wide activities in extension work, but the point now has been reached, it is believed, where the states and local agencies are sufficiently acquainted with the work to carry forward the educational part of the program.

Increased research is planned on such problems as the flow of water in drainage ditches; drainage by pumping, and the effects of alkali waters on concrete.

PUEBLO COUNTY, COLO., PLANS BIG HIGHWAY PROGRAM

Plans have been completed for further improvement in 1923 of two important highways radiating from Pueblo, Colorado. One appropriation of $60,000 from the Federal Government will be spent on the Santa Fe Trail running east from Siloam road connecting Pueblo and Westcliffe. It is also expected that $18,000 will be available for surfacing on the north and south highway from Bragdon to the El Paso County line.

A traffic count shows that the bulk of the automobile travel coming into Colorado comes over the Santa Fe Trail. Provision is made for the spending of $60,000 on this road fron the Huerfano River east to the county line.

By the end of 1923 Pueblo County will have expended a total of $408,000 on her roads, which are now looked upon as among the best in the state.

ARKANSAS HAS 28,700 MILES OF IMPROVED ROADWAYS

Arkansas now has 28,700 miles of improved road not including that added during last season, according to the U. S. Bureau of Public Roads, which has made a complete census in the State. The improved road mileage at the beginning of 1922 was as follows:

Graded and drained	24,829
Sand Clay	150
Gravel, chert, and shale	2,869
Water-bound macadam	320
Surface treated macadam	73
Bituminous macadam	154
Sheet asphalt	12
Bituminous concrete	219
Cement concrete	74

The total road mileage of the State is now 74,866 miles, as compared with 50,743 miles in 1914. During the seven year period from 1914 the graded and drained mileage has increased from 16,305 to 24,829, and the surfaced and paved roads from 1,098 to 3,871 miles. The total road revenue in 1921 amounted to $22,886,970 or $435 for each square mile of area, $305 for each mile of road, or $13.06 per capita. At the end of 1921 there were 1,782 miles of State-aid road.

WISCONSIN ROAD SCHOOL TO OPEN JANUARY 22

The Annual Road School and Good Roads convention of the Wisconsin Highway commission will be held at Madison during the week of January 22, 1923. At this meeting county highway commissioners and county road officials, and foremen, contractors and many good roads boosters in the state will be present. Plans for work contemplated during 1923 will be discussed. The banquet in connection with this meeting will be held Thursday night.

This is one of the largest state good roads gatherings in the country and several large machinery exhibits showing improved road making machinery are usually present. The program for the meeting is now being arranged for. A. R Hirst, state highway engineer, predicts this will be one of largest gatherings in years, due to the fact that the state legislature will be in session and considerable interest is being centered on new road legislation.

BRITISH MINISTRY OF TRANSPORT ENDORSES BANKING OF HIGHWAYS AT CURVES

According to a recent announcement from the offices of the Permanent International Association of Road Congresses in Paris the British Ministry of Transport has directed its divisional road engineers, to see that local officials in constructing highways in England, allow for super-elevation of roadways on corner curves wherever desirable. The action was taken following investigation and recommendations by the British Roads Improvement Association which pointed out the benefits to be gained through banking at

California Highway Commission Asks $135,000,000 For Roads

Sum is Necessary to Take Care of Present System—Another Bond Issue Imperative

California faces an expenditure of $135,000,000 on its state highway system, taking into account only the roads now in the system, and without regard to new mileage that may be brought in by legislative action or vote of the people, according to the outstanding features of the biennial report just submitted to Governor Stephens by the California Highway Commission.

The $135,000,000 is made up of $100,000,000, estimated to complete the present unimproved mileage of the state highway system, and $35,000,000, to widen and thicken arterial highways of the state and to eliminate railroad grade crossings from the highway system. Credited against this estimate of $135,000,000 are funds remaining in the $40,000,000 bond issue, Federal Aid funds that will be available under future Congressional appropriations, and allotments to projects now under way but not completed.

Major recommendations included in the report follow:

1. While another bond issue appears to be imperative, the users of the roads should be asked to bear a larger share of the highway burden than has been placed upon them in the past.
2. Future bond issues should not contemplate providing funds for the completion of the entire system. The public should realize that the completion of the state highway system is many years in the future and that as California grows, its road system must grow with it.
3. The preferable method is to ascertain the amount of work that can be economically and efficiently undertaken by the California Highway Commission in any one year, and under normal building conditions. With this ascertained, the work should then be financed for a period of not less than five years. In the opinion of the Highway Commission $12,000,000 represents the maximum annual construction program that should be undertaken under present building conditions and costs.
4. Such a plan would require a rigid budgeting of the funds of a bond issue. Some financial flexibility is absolutely necessary in the conduct of the the work. This can be secured if federal funds are left unbudgeted.
5. The gasoline tax and an increase and equalization of the motor vehicle fees offer a practical and fair method for imposing a larger share of highway costs upon highway users.
6. The legislature should definitely and rigidly refuse to designate roads as state highways unless at the same time finances for their improvement and maintenance are provided; nor should any roads be included in a bond issue unless a definite allotment for the construction of these roads is made.
7. The maximum permissible weight on state highways should not exceed 22,000 lb. It is now 30,000 lb.
8. An adequate force of state motor police be authorized for the enforcement of traffic laws on state highways.
9. The above police be under the authority of the State Highway Commission, the body responsible for the protection and maintenance of highways.

sharp curves in the way of safety to traffic. In the event of two vehicles meeting at a curve it was declared, they could be maneuvered on a banked curve with more certainty and less risk of skidding. It was also declared that there would be much less wear upon the pavement. French road engineers long ago adopted the banked curve and in some parts of the United States htey are now in use.

OHIO WILL KEEP ROADS CLEAR THIS WINTER

In line with the practice adopted by the leading State Highway Department of the County, the Ohio Department is taking steps to provide for snow removal on all its important roads.

State Highway Director Leon C. Herrick states that the department proposes to station tractors, equipped with snowplows and scrapers, at various points to cope with the snow problem. Thousands of motor trucks are in operation in Ohio and will be needed this winter to aid the railroads in carrying coal and other commodities. Merchandise trucking lines making rapid deliveries have been established between almost all towns of importance in Ohio and adjacent territory and to keep traffic and the large volume of passenger traffic, moving, some 200 plows and auxiliary equipment will be required.

CALENDAR OF COMING MEETINGS

Jan. 11-12—FEDERATED AMERICAN ENGINEERING SOCITIES. Annual meeting, Washington, D. C.

Jan. 15-17—NATIONAL CRUSHED STONE ASSOCIATION. Annual convention, Chicago, Ill.

Jan. 15-18 — AMERICAN ROAD BUILDERS ASSOCIATION. Annual convention, Chicago, Ill.

Jan. 17-18—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, New York City.

Jan. 22-26—AMERICAN CONCRETE INSTITUTE. Annual convention, Cincinnati, Ohio.

Jan. 23-25—ILLINOIS SOCIETY OF ENGINEERS. Annual meeting, Peoria, Ill.

Jan. 23-26—IOWA ENGINEERING SOCIETY. Annual Meeting, Des Moines, Ia

Jan. 24—BOSTON SOCIETY OF CIVIL ENGINEERS. Boston Mass.

Jan. 25-26—SOUTH ATLANTIC COASTAL HIGHWAY ASSOCIATION. Charleston, S. C.

Jan. 27—NORTHEASTERN SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, Boston, Mass

Jan. 30-Feb. 3—ASSOCIATED GENERAL CONTRACTORS OF AMERICA Annual meeting, Los Angeles, Calif.

All Records for Road-Building Broken During 1922 Says U. S. Bureau of Public Roads

Federal Aid Projects Total 10,000 Miles for Fiscal Year

All records for road construction in the United States were broken during the fiscal year 1922, according to the annual report of the U. S. Bureau of Public Roads recent made public. During that period 10,000 miles of Federal-aid roads and more than an equal mileage of highways without Federal assistance were constructed.

From the viewpoint of Federal-aid progress the year divides itself into two periods, one before and the other after the passage of the Federal highway act. The first period was a season of great construction activity during which the greater part of the work of completing the 10,000 miles was done. It was also one of almost complete stagnation with respect to the initiation of projects.

When the year opened there was an unobligated balance of $18,793,544 of the Federal-aid appropriations and the projects initiated since the beginning of the work aggregated 35,402 miles. By the end of October, 1921, the unobligated balance had been reduced to $11,714,328, the lowest it had been cince 1918. Only two states at that time had a balance of more than $1,000,000 to draw upon for new projects, and a number were so reduced that their balance was not sufficient to pay for another mile of road.

Just before the passage of the Federal highway act the mileage submitted by the states had not grown during the fiscal year but had actually diminished as a result of the withdrawal and substitution of projects. The total mileage proposed was only 35,379 miles as compared with the 35,402 miles of four months before. Immediately upon the approval of the act the initiation of projects took on new life and in the months of March and June reached the unprecedented total of 1,250 miles a month. At the close of the year the submitted mileage is 39,940 miles, 4538 miles greater than at the close of the preceding fiscal year.

At the close of the preceding year projects completed aggregated 7469 miles and there were 17,978 miles under construction, which were estimated as 50 per cent complete. In one year the completed mileage has grown to 17,716 miles, an increase of more than 10,000 miles, and there still remain under construction 14,513 miles which are estimated as 56 per cent complete. The Federal aid earned by the states on completed and uncompelted projects amounts to $194,560,135, of which $166,911,552 have actually been paid.

The total length of projects in all stages, including those which have been completed and those which are in the stages preliminary to construction is 39,940 miles.

The roads brought to completion during the year average over 200 miles for each state. The greatest increase in completed mileage is in Texas, which has added during the year 933 miles to its compelted highway. Arkansas, Georgia, Iowa, Minnesota, and North Calorina, each with an increase of more than 500 miles, and Montana and Wisconsin, with more than 400 miles, made notable advances toward the goal of a completed highway system.

A number of smaller states, such as Louisiana, Maryland, Massachusetts, and Rhode Island, made very substantial increases in proportion to their size.

The largest payment of Federal aid during the year also went to Texas, which received from the Government $5,915,046 and earned nearly $2,500,000 more. Other large payments were made to Ilinois, Iowa, Ohio, and Pennsylvania, each of which received from $4,000,000 to $5,000,000 or more during the year.

SOUTH DAKOTA HIGHWAY PROGRAM FOR 1923

1923—Approximately 400 miles of state highway construction is planned in South Dakota for 1923. In addition many of the roads graded during 1922 will be graveled in 1923. Along with the highway work will be a corresponding amount of bridge construction.

TWO HIGHWAY BILLS TO BE SUBMITTED TO MONTANA LEGISLATURE

Members of the Executive Road committee of Montana met recently at Butte with W. R. Dennis of Carelton, Ore., chairman of the Oregon road legislation committee, and F. A. Cannon, secretary of the Wisconsin Good Roads association, and drafted two highway bills for submission to the legislature. The first will provide for raising the present one cent tax on gasoline to two cents and taking it from the school fund and putting it into the road appropriations. The second bill will provide for changing the present method of levying taxes on a car. The new method is modeled along the Oregon and Wisconsin lines of charging so much for the weight of the car and a percentage of its value. In this matter old cars do not pay as much as the new ones, as they depreciate in value. Sid J. Coffee of Missoula is president of the association and P. L. Wills of Butte is secretary.

OHIO DECLARES WAR ON ROAD SIGNS

The State Highway Department in Ohio has gone on the warpath against advertising signs along the roadways. Recently it tore down and carted away, in one county, nine truckloads of signs found along the main touring routes.

The official objection to the signs is that they obscure the traffic signs and confuse the motorists. Their elimination for this reason is permitted by a state law. Hereafter, announces the state superintendent of highways, no signs other than traffic signs will be permitted within the 60 foot limits allotted for roads. Within those limits signs may be erected only by the State Highway Department.

FOOTPATHS PROPOSED FOR NEW JERSEY ROADS

A bill will be presented to the next session of the New Jersey legislature providing for the construction of footpaths along the state highways. New Jersey has hundreds of miles of beautiful tree-lined asphalt roads and the State Highway Commission is favorable to the footpath idea, believing that the paths will keep pedestrians off the roadway and thereby greatly reduce highway accidents.

NEW JERSEY ROAD BONDS BRING PREMIUM

Bids for $2,000,000 worth of 4½ per cent highway bonds of the State of New Jersey brought offers on Dec. 19, from nine bidders, the successful bid for the entire issue being at the rate of 102.097. Several bids for portions of the issue ranged from par to 103+ but the syndicate bid gave a higher yield than the best of the fractional bids.

MONTANA HIGHWAY PROGRAM FOR 1923

Surveys and plans for the Federal Aid projects in Montana proposed for 1923, now being prepared by the State Highway Commission of that state, involves 255 mlies of grading and gravel surfaced road, and sixteen bridges of more than 20-ft. span. The 1923 work involves over 1,640,850 cu. yd. of common excavation, 118,800 cu. yd. of rock excavation, 380,000 cu. yd. of surfacing and 744 pipe culverts.

ASSOCIATION OF HIGHWAY OFFICIALS ELECT OFFICERS

At the recent annual meeting of the American Association of State Highway Officials held at Kansas City, C. J. Bennett, state highway commissioner of Connecticut was elected president. F. R. White, chief highway engineer of the Iowa Highway commission, was elected vice-president. The executive committee will later choose the meeting place for the next convention.

PAVING OF MODEL STRETCH OF LINCOLN HIGHWAY COMPLETED

The paving of the Ideal Section on the Lincoln Highway in Indiana, 37 miles south of Chicago and adjoining the Illinois State line, has been completed. The section will not be open for traffic however, until the completion of the two bridges, which are expected to be finished the first of the year.

The completion of the pavement and the bridges does not by any means complete the Ideal Section. Early in the spring the proper grading of the shoulders, the landscaping of the right-of-way and the installation of the gravel pathway for pedestrians will be undertaken. The installation of the modern lighting will also be delayed until spring, but the heavy work of grading and paving is out of the way, and already the model section gives an indication of its ultimate appearance.

COLORADO PLANS BIG ROAD BUDGET FOR 1923

Members of the Colorado State Highway Advisory Board, recently met in Denver, for the purpose of discussing a tentative draft of the road budget for 1923. They were in session four days.

An unofficial estimate of the expenditures to be made by the Highwav Department in 1923 is approximately $9,250,000. This includes a total of about $3,600,000 in projects to be carried over from this year.

This work will probably be divided as follows: concrete pavement, 64 miles; gravel surfacing, 96 miles; sand clay surfacing, 6 miles; grading and drainage, 58 miles, and three miles of bridges and approaches.

These figures, of course, do not include the state aid projects that will be constructed in the various counties by the Highway Department.

Tentative provision is made in the 1923 budget for the construction of 38 Federal Aid Projects, totaling 37 miles of concrete paving; 57 miles of gravel surfacing; six miles of sand clay surfacing; 32 miles of grading and drainage, and one mile of bridges and approaches.

As far as it is possible to estimate at this time the department will construct all together about 227 miles of Federal Aid Projects, including the uncompleted projects the coming year.

During 1922 the department completed 210 miles of Federal Aid roads as follows: 113 miles of gravel and rock surfacing; 20 miles of concrete paving; 47 miles of graded roads; 30 miles of sand clay surfacing, and three bridges.

There is now under construction 110 miles of Federal Aid Projects, divided as follows: gravel surfacing, 54 miles; concrete pavement, 27 miles; graded roads, 21 miles; crushed rock surfacing 7½ miles, and six bridges.

Equipment—Trade—Materials

NEW BULLETINS ON KOEHRING CRANE EXCAVATORS NO. 2 AND NO. 3

The Koehring Company of Milwaukee, Wis., describes in two recent bulletins their No. 2 and No. 3 Crane Excavators. The first of these is rated at 12 tons capacity, at 12 in. radius and the second at 20 tons, at the same radius.

Koehring Crane Excavator No. 2 is designed for any kind of material handling, excavating or grading. It may be equipped with dragline, orange peel, or grab bucket, power shovel attachment, pile driver leads, magnet, or block and hook. All functions are entirely independent of each other, a separate lever being used for each and any function—hoisting, peaking, sluing or rotating, and propelling —can be operated separately or in combination, in any order desired.

Two line speeds are provided to ensure a maximum of output. To change from clamshell operation to dragline work, it is necessary only to change buckets and shift a clutch to give a slower speed and greater power; to change from dragline to clamshell, merely reverse the process and a greater speed is obtained for the clamshell work. None of the machinery, gearing or drums need be changed in any way. In like manner, to change to power shovel work, no rebuilding or removal of any machinery parts is necessary. All that is required to change the booms and add the dipper handle and shovel with proper cables and drive parts.

Power for Crane No. 2 is furnished by a 4 cylinder, 70 h. p. gasoline engine, with distributing type air starter or electric starter furnished if desired. Its operation on speeds are as follows:

24,400 lb. 27½ ft. and 45 ft. per min.; 18,000 lb. 36½ ft. and 60 ft. per min.; 12-000 lb. 55 ft. and 90 ft. per min.; 6,000 lb. or less 110 ft. and 180 ft. per min. The rotating speed is 3.3 r. p. m. The traveling speeds either forward or backward are as follows 7/16, ⅞ and 1⅜ m. h. p.

All movements of Crane No. 3 are also independent of each other, and can be operated separately or in any combination desired the same as for Crane No. 2. All movements of the crane are controlled independently by outside band frictions.

The power plant on Crane No. 3 is a 4 cylinder, 100 h. p. gasoline engine, while its operating speeds are as follows:

40,000 lb 27½ ft. and 45 ft. per min.; 30,000 lb. 36½ ft. and 60 ft. per min.; 20,000 lb. 55 ft. and 90 ft. per min.; 10,000 lb. or less 110 ft. and 180 ft. per min.; The rotating speed is 3 r. p. m.

Traveling Speeds: ⅓, ⅔ and 1⅛ m. p.

Traveling Speeds: ⅓, ⅔ and 1⅛ m. p. h.

AUSTIN PRODUCES A NEW ASPHALT PLANT

A number of innovations are embodied in the Austin Asphalt Plant recently announced, and shown in the accompanying illustration. It is a portable unit consisting of three pieces, namely, the dryer and power plant, and two asphalt kettles.

The plant has a capacity of from 1000 to 1400 sq. yd. of 2-in. asphalt top per 8-hr. day. The sand dryer will handle 120 tons of sand at 350 deg. fahr., not to contain more than 2 percent moisture. The dryer sets forth one of the particular features of the plant. Three drums are built into a unit, equal to a single continuous drum 4 ft. 3 in. in diameter by 40 ft. 8 in. long, giving the material an area of 438 sq. ft. of heating surface. This amount multiplied by 8 r. p. m. and the total by 4 min., the time required for the material to travel through the drums, gives an area of 12,912 sq. ft., with which it must come in contact. Thus, the highest temperature required is secured at a very low fuel cost.

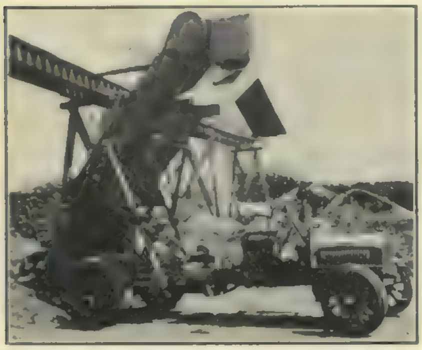
The kettles have a total capacity of 2500 gals. These are heated by steam through jointless coils and this construction prevents any possibility of damage to the asphalt and is far superior to the kettles heated by open fire.

The pug mill of 1000 lb. capacity is chain driven and discharges through a sliding gate in the bottom. Extra large steam jacketed steam piping is used throughout. Air is used to agitate the asphalt. The hot sand bin is of three compartments with a capacity of 10 tons.

HAISS MANUFACTURING COMPANY NEW CREEPER WAGON LOADER

Several truck loader elevators which can be mounted on motor trucks have been furnished road contractors recently by George Haiss Mfg. Co., Inc. Such a piece of equipment is essential in many cases where high speed loading of material is required at a number of points, as the combination gives great mobility and flexibility to the fast and efficient path digging loader element.

As examples of the trucks which have been so equipped, one belongs to a contractor in Toronto, who has several gravel banks located some miles apart and who also receives material by rail; another is owned by a large New York trucking contractor and is used on sand and gravel, earth spoil, etc., all over the city.



As the accompanying illustration clearly shows the regular path digger elevator is used, with double chain, toothed buckets, and feeding propellers so that no shovelling is required for a path into the pile for the loader. It is pivoted on standard A frames over the rear wheels, to be collapsed while traveling. A two-way side discharge chute is provided at the top for loading on either side.

The elevator is driven either from the jack shaft, if the truck is equipped with one for a dump body, or by a separate engine. The latter plan is more expensive but more efficient, as the truck chassis can be moved while loading. The capacity is 1 to 2 cu. yd. per minute.

AMERICAN CEMENT MACHINE COMPANY ISSUES NEW CATALOG

Boss mixers of the heavy duty type are illustrated and described in a catalog—No. B 23—recently issued by the American Cement Machine company of Keokuk, Ia. The new catalog contains many interesting facts and figures, showing that the big volume of production now permits the use of special labor saving machinery which has lowered manufacturing costs over 30 per cent.

Trade Publications

T. L. Smith Company Describes New Paver

The T. L. Smith company of Milwaukee is distributing publication 1003, which gives interesting information on the performance of Smith pavers of the present model—first shown at the 1922 road show. Many field views are shown with complete day-by-day performance data on a trunk highway.

Charles T. Topping Machinery Company Describes Pony-Ditcher

The Charles T. Topping Machinery Company of Pittsburgh, Pa., has issued a new catalog "Facts about Topping, the Pony-Ditcher" which describes in some detail and gives many interesting figures showing operating costs for their small general purpose trenching machinery, which is designed to do work heretofore largely done by hand. This machine does not intend, the makers state, to replace the more powerful machines of larger capacity or heavy weight class, but has been produced to perform a broad range of service.

White Company Issues Booklet on Bus Operation

An attractive 24-page booklet has just been issued by The White Company giving a wealth of information on the use of motor busses. The booklet which is profusely illustrated shows a wide variety of designs suitable for every field of bus operation. It covers in detail the operation of busses in city service as traction line feeders, on inter-city lines, for deluxe tours, for schools and institutions and for parks and sightseeing. According to information contained in the booklet there are more than 3200 White busses in service. The White Company about a year ago brought out a special bus chassis, known as Model 50, and the company reports an especially large sale of these models during the year.

Portland Cement Association Publishes "Progress Review" of Twenty Years"

The Portland Cement Association has in commemoration of the twentieth anniversary of the organization of the company, just issued a forty-page booklet under the heading "Progress Review of Twenty Years" which briefly describes the early history of the association and its progress during the course of the last twenty years. The booklet contains many interesting illustrations showing the remarkable growth of the association and a series of short articles showing the progress made in the scientific study of the uses of Portland cement, the development of Portland cement specifications, and the progress in the mechanical features of cement manufacture. The book brings strikingly to the fore, the ever increasing uses of this important material.

As evidence of the development of concrete for highway surface, the bulletin presents some interesting statistics which show the vast sums now being spent for highways as compared with approximately $59,000,000 was spent for highway construction and maintenance, whereas in 1922 $720,000,000 was spent, and during the same duration of time, the registration of motor vehicles increased from 96,000 in 1904 to 10,620,000 in 1922.

Aeroil Burner Company Bulletin Describes Thawing Outfits and Concrete Heaters

The Aeroil Burner Company, Inc., of Union Hill, N. J., have just issued Bulletin No. 26 describing their line of Aeroil thawing outfits and concrete heaters.

These heaters consumes but a small amount of kerosene oil, the flame is clean, without smoke, and is not affected by wind, rain or snow. Their usefulness is not confined to thawing alone, but can be used for preheating, and drying concrete for waterproofing, etc. It is claimed that concrete heated by the Aeroil method remains warm from 48 to 56 hours after it has been poured, thus insuring smooth, even and strong work.

Truscon Issues New "Architects Specification Hand Book"

The Truscon Laboratories of Detroit have recently issued a new specification handbook which is intended to give architects and engineers up-to-the-minute information concerning waterproofing, oilproofing, floor hardeners and protection finishers. The book is the revised edition of the Truscon specification book, and every effort has been made to make the revision as clear and concise as possible, and to omit all superfluous details. The book is 8½x11 inches in size and contains 108 pages. The binding os loose-leaf, thus making the set of specifications readily adaptable for use either as a reference work or for any other classification that may be adopted by the engineer's or architect's office. The Truscon Laboratories will be pleased to send this book to architects or engineers who request it on their own letterheads.

Personal Mention

H. A. Keller, formerly resident engineer with the North Carolina State Highway Department, has been appointed district highway engineer in Albermarle County. Virginia.

R. M. Cooley, for ten years a member of the engineering staff of the Minnesota State Highway Department, St. Paul, has resigned to represent the Holt Manufacturing Co., in Minneapolis.

J. R. Vernon, has resigned his position as assistant division engineer for the Wisconsin Highway Commission at Lancaster, Wis., and has accepted a position in the Chicago office of the Johnson Service Co.

Robert Jemison, Jr., has been appointed a member of the Alabama Highway Commission to succeed S. R. Batson, who resigned in order to devote his entire time to private practice.

W. V. Buck, assistant engineer of the Kansas state highway commission, has resigned to enter the automobile business at Newton, Kan.

R. D. Short, formerly concrete designing draftsman with the Kentucky Highway Department, is now concrete designer for the Sinclair Refining Co.

D. C. Willett has resigned his position as assistant structural engineer with the California State Highway Commission to accept the position of superintendent of construction with the Division of Architecture of California.

L. L. Rush, assistant engineer of the Kansas Highway Commission, has resigned to accept a position on the engineering force of the Chicago Union Station.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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TABLE OF CONTENTS

Motor Traffic on Highways 27
By J. D. Fauntleroy

Who Should Pay the Cost of Road Construction . . 29
By R. M. Hubbard

Subgrades and Subgraders 30
By R. B. Gage

How Good Roads Are Developing My Community . . 31
By Karl G. Pearson

CURRENT EVENTS IN THE FIELD OF HIGHWAY ENGINEERING AND TRANSPORT

Iowa Builds 1069 Miles of Permaeunt Roads . . . 32

Colorado Completes Elk River Road 32

Kentucky Court of Appeals Renders Decision on Simmons Bill 32

St. Lucie County, Florida, Concentrating on Good Roads 32

Big Paving Program at Fargo, N. D. 33

New Pittsburgh Tests Under Way 33

Lee Highway Convention Postponed 33

Virginia and West Virginia Contractors Organize . . 33

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Vol. LXIV JANUARY 17, 1923 No. 3

Motor Truck Traffic on Highways

A Highway Builder's View

By J. D. FAUNTLEROY

Texas State Highway Engineer.

THE development of motor truck traffic in the state of Texas has been very rapid. In 1917 there were registered approximately 15,000 motor trucks and at the present time from best estimates which are available that there are approximately 50,000. We have no exact figures as to the total number of trucks which are operated in the state for the purpose of carrying freight but the following are interesting.

Smith county reports truck traffic increased 100 per cent since their highways were improved two years ago. Four large grocery houses are now handling 60 per cent of their outgoing freight in trucks. One large concern with 14 branch houses uses trucks extensively in handling their goods between branch houses in trucks operated by the firm, but make no deliveries to customers. Only 40 per cent of their goods are handled by railroads or by wagons. Another large wholesale firm handles 65 per cent of all their outgoing freight in trucks and also deliver to customers in trucks, because it is claimed that in this manner they can make much faster deliveries than can be secured by raliroads. Their branch houses at Palestine and Lufkin only handle 30 per cent of their deliveries by trucks because the surrounding roads are not improved.

Trucks That Operate on Schedule

Orange county reports that although the highway between Orange and Beaumont lacks 6 miles of being completed, there is now one truck line operating between these cities. This truck carries a trailer and delivers goods from wholesale houses in Beaumont to retail stores in Orange. It makes a round trip every day. It haul sprincipally fruits and vegetables and effects a material saving in price as compared with railroad service. There are also 10 other trucks operating this route but not on regular schedule.

Harris County reports that

Road	Heavy Trucks	Light Trucks
LaPorte	88	99 per day
Galveston	47	73 per day
Almeda[1]	24	40 per day
Humble	33	88 per day
East Montgomery	19	111 per day
Washington County	15	52 per day
Main Street	21	43 per day

Tom Green county reports that in the past two years the traffic over State Highway No. 4 south into Schliecher county and Sutton county has become almost entirely motorized which means that about 3,000 human beings are now being supplied with food and other necessities by trucks whereas two years ago only prairie schooners were used for this purpose. The great advantage of this change in tranportation can be readily appreciated when we consider that there is no railroad in either of these counties and Sonora the county seat of Sutton county is 70 miles from a railroad. This highway is now being improved throughout but only 25 miles are completed at present.

Trucks Replace Railroads

El Paso county reports that for the past two years a truck line of 4 trucks has operated regularly between El Paso and Las Crucas, N. M., 48 miles, and has given good service picking up inbound and delivering outbound freight of any class such as milk, calves, potatoes or manufactured products. The delivery is from farm to store or vice versa. Deliveries are prompt. On account of this truck line we are informed that the Santa Fe now only handles freight between these two points in carload lots. Two trucks are operated in the lower valley between El Paso and Fabens—29 miles. This line also handles morning and evening papers so that farmers get their papers just as soon as people living in El Paso. Another truck line operates between El Paso and Roswell, N. M. It brings in milk, chickens, eggs and other farm produce and goes back loaded with dry goods, groceries and farm implements. It shortens the time between El Paso and Roswell from one to three days and puts a large section of mountain country without railroads in close touch with El Paso. The operation of trucks has had an appreciable effect on the business of the railroads as to freight traffic. All material used in building the Alamo Gordo road was hauled in trucks as that method was cheaper than the railroad haul. All cement used in the construction of the Anthony-Las Cruces Highways was hauled in trucks direct from plant and at a considerable saving. All lumber dealers in El Paso make delivery of materials by trucks t oany place in the county. Oil companies in like manner use trucks to deliver gasoline and oil at any ponit desired in the county. All local hay is brought in trucks or by wagons and no hay is shipped by rail to El Paso

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Abstract of a paper presented before the Houston Chapter of the American Association of Engineers, November 29, 1922.

[1] This has more than doubled since traffic census was taken.

except for rebuilding to other points. This applies to practically all other farm products. On a rough estimate it appears that the local freight business done by the railroads is today 10 per cent. of the total local freight handled within a radius of 100 miles of El Paso.

Wichita county reports an actual traffic count on the Wichita Falls-Iowa Park road taken in August shows 157 trucks and this varied little from day to day.

On the Dallas-Fort Worth road an actual count of traffic on August 26, 1922, showed:

Heavy loaded trucks	93
Trailers loaded	13
Heavy trucks empty	38
Trailers empty	9
Light trucks loaded	137
Trailers loaded	1
Light trucks empty	182
Trailers empty	3

It is also interesting to note that the total traffic over this road on that date consisted of 4,088 vehicles of which all but 35 were motor vehicles. We are also informed that the through freight traffic over this road has cut very deeply into the receipts of the interurban and railroad lines between Dallas and Fort Worth. The greatest claim in favor of trucks is that they receive their freight at the merchant's door and deliver it in three or four hours to the buyer's door, thereby saving not only considerable time but relieving the customer of the bother of having to hire a dray or delivery wagon to go to th edepot and haul this purchase home, in case it should have been brought over by railroad.

The Motor Truck and the Farmer

The U. S. Department of Agriculture reports that due to the use of trucks the farmers haul to market has increased from 6.9 miles to 17.6 miles, in other words the farmer is now much nearer market than before the trucks came into general use and as a general proposition we feel safe in stating that the motor trucks ahve penetrated further and further into remote rural sections thus providing a connecting link between the points of food production and the points of marketing.

It should be borne in mind that there are in the United States approximately 26,000,000 food producers who are trying to feed themselves and also the other 79,000,000 American citizens, and we should therefore welcome any new means of transportation that will simplify the transportation of food products to consumer and thereby tend to lower the cost of living for at present out of every dollar which the consumer pays for his food, the original producer gets only 35 cents. It appears that especially in case of fruits, vegetables and other perishable products that the motor truck has a special and very necessary function to perform and if it can cheapen the price of food to the consumer and at the same time cut out the middleman so as to give the producer a better price for his products, it will be entitled to fair treatment by our law makers.

Unlooked for increase in the use of motor trucks for carrying freight, whereas it undoubtedly has proven beneficial to many merchants and their customers, has also its corresponding disadvantages. Many gravel roads and iron or eroads, for example, which were built with the expectation of carrying ordinary farm traffic and a reasonable amount of auto traffic have been very much damaged and some of them almost destroyed in a short time by the use of heavy trucks and the result is that we have roads now in a bad condition of repair which will require large expenditures to put them in proper shape and for which no funds are in sight. Nevertheless the bonds which were voted and sold to pay for these roads will not be retired for perhaps 25 or 30 years. The condition is therefore a very serious one.

The state legislature has prescribed laws regulating traffic upon highways but the enforcing of these rules rests with the Commissioners' Courts of the different counties and in many instances it seems that little or no effort is being made to carry out the intention of the legislature. It appears that if the roads are to be adequately protected from destruction by heavy trucks and by overloaded trucks that some means must be found to enforce the traffic regulations, probably by giving some centrla body the necessary authority to see that the laws are enforced.

Maryland's Peculiar Position

The state of Maryland finds itself in a peculiar condition in that it has the most complete system of improved highways of any state in the union, but it is surrounded by states that have their highways in more or less completed conditions. Also located around Maryland and near its borders are many large manufacturing cities. As a result there has grown up on the Maryland roads a tremendous truck traffic and these trucks are frequently licensed in adjoining states. The general tendency of these trucks is to be overloaded. As a result Maryland authorities found their roads being in imminent danger of destruction by these foreign owned trucks. It was decided to try the experiment of weighing each heavily loaded truck to see if it was overloaded and if they were overloaded to fine the owners and to compel the overloaded trucks then and there to remove part of their loads so as to come within the limits prescribed by the law. It worked like a charm. Of course the truck drivers cursed and swore, but the highway policeman after testing the load by mean sof small portable scales, compelled the drivers to unload a portion of their load alongside the road, where it would lay unprotected until the driver could arrnge to haul it to some nearby store or farm house for storage. In a little while there were no more complaints as one experience of unloading was enough for any single driver.

The State Highway Commissioner of Maryland informs me that in 1918 heavy trucks were permitted to operate over the main highway running north and south through Baltimore and that many of these trucks were overloaded. As a result the road was practically destroyed and had to be reconstructed at a cost of $600,000. If all of the loads carried over the road during this period by these trucks had been within the legal limit the road would not have been destroyed but could have been maintained at a reasonable cost. He estimated that by overloading these trucks instead of using more trucks with lighter loads that the truck owners had saved about $16,000 whereas the cost of reconstructing the road to the State was $600,000.

To give you an idea of the damage which may be done to roads by heavily loaded trucks, I wish to quote two examples with which I am familiar.

On one occasion was resident engineer on a 12 mile section of gravel road which was just about complete and the contractor expected to turn it over within a day or two when there came a slow rain which lasted a day, and immediately thereafter a heavy truck loaded with plows, and discs and other hardware passed over the entire length of the road, leaving ruts in it from two to four or five inches deep. It actually cost the contractor $600 to go over the road and put it into shape for it to be accepted, due to the destructive effect of this one truck.

In Massachusetts the state builds the main highway thoroughfares and the towns are required to build the cross roads and feeders. The Commissioners of Highways for the State of Massachusetts informed me that one occasion a large truck heavily loaded, went out of the city of Boston over a main highway and then made a detour of 12 miles through vraious country districts and eventually returned to the city over the main highway. This truck did great damage to the gravel and macadam road over which it traveled and seriously damaged or broke down 22 culverts and bridges. It was estimated that the damage done by this one truck was in the neighborhood of $12,000.

Another matter which is worthy of serious consideration is the fact that many of our main highways parallel railroads and the construction of such highways is largely paid for by the proceeds of district highway bond issues. The railroads being in the district necessarily will pay their proportional part for the cost of building these hghways. The fees which the trucks pay are in many instances totally inadequate to repair the damage done to the roads by the use of the trucks s owe have this peculiar condition existing—that the railroads are helping to pay for the improvement of highways which parallel their lines and which roads are being destroyed by trucks whose business it is to take traffic away from the railroads.

It seems to be the opinion of many thinking men that not until the truck operator shall contribute his due proportion to the cost of highway construction and maintenance, can his right to use the highway be considered equal to that of the ordinary taxpayer. This is the conclusion of the Public Utilities Commission of Colorado in a decision rendered on March 8, 1922.

The Colorado Commission held that through abuse of the highways by inadequately taxed busses and trucks, "the 137,336 passenger car owners of the state are grievously wronged" and "the farmer and city home owner pay the bills."

In a similar decision, June 14, 1921, the Public Service Commission of Pennsylvania declared, "public interest would immeasurably suffer" if auto lines were permitted to engage in destructive competition with the railroads that were providing reasonably adequate service to their territories. The Pennsylvania Commission in a decision March 16, 1921, refusing to permit an auto line to parallel an electric railway, pointed out that the proposed competition would mean either increased rates or impaired service for the patrons of the electric line.

These decisions are important because they enunciate first principles relating to regulation and taxation of highway carriers and have vital bearing on conditions in every state today.

It may not be amiss to state in this connection that the use of highways by jitneys and bus lines is also having a very serious effect upon the revenues of the railroads. We are informed that at one station on the Katy Railroad, due to the general use of jitneys and busses over an improved highway which parallels the Kay Railroad, the passenger receipts in the month of June were $1500 less than in June, 1921.

(Continued on Page 7)

Who Should Pay the Cost of Road Construction?

By R. M. HUBBARD

Chairman, Texas State Highway Commission.

IN the early days of the automobile industry the name "pleasure car" was more or less applicable. But today it is clearly a misnomer. Just a short time back, the purchase of a car was made, mainly on account of the pleasure, in a great many instances imaginary, that the purchaser anticipated. It was truly a luxury. Today it has become an absolute necessity in the economical and successful carrying on of all lines of business, agricultural as well as commercial.

It is this fact that has caused the minds of the people to dwell more and more on improved roads, and following the idea to its logical conclusion, the people of our state are fast realizing the crying need of a connected state system of highways.

The old idea of road building was that the people who lived along the road were the only ones benefited by the improvement and should, therefore, pay all the cost of securing it.

The theory now universally accepted, recognizes the benefits to the general public, as well as to the local users, of a durably constructed, well located and connected system of roads. Hence the growth and popularity of the idea of state and Federal participation in road construction.

Highway development has ceased to be a local problem but has become a highly important one of growing public interest, closely connected and associated with the great problem of increasing the price of agricultural products to the producer, and decreasing the price paid by the ultimate consumer, eliminating a great part of the enormous spread between the grower and consumer. Agriculture and good roads are closely connected. The prosperity of this country rests on the building up of agriculture more than on any other one thing. Agriculture must receive an adequate return on its investment and labor, if we expect to go forward, or even hold our own. Good roads are directly connected with these basic principles. Highway transportation will not only help the farmer but will also aid the consumer.

In connection with the construction of a great state system there arises the greatest problem of them all, namely the most economical and equitable manner of financing, completing, and by no means least, maintaining such a system, without placing an undue burden on agriculture or any other interest.

There is a nation and state wide protest against high taxes, and properly so. On the other hand the demand for more roads and better roads is more and more insistent. How can we procure the latter without the former? Real estate is carrying about all the burden it can or should stand. Industrial concerns are hampered with ever growing over-head expense. Capital is turning to tax-exempt securities. We certainly do not want to place any additional burden on agriculture. Then to what sources of revenue shall we look?

Abstracted from the "Texas Highway Bulletin."

There seems to be only one fair solution. Let those who receive the benefit pay the cost. A just method of taxation can be evolved, that will fairly distribute the cost among those who do receive the benefits, at least as just as any scheme of taxation thhat can be devised.

But who does receive the benefits? It would be easier to name those who do not. One trend of thought follows the theory that the users of the road should bear all the burden, not only of construction, but also that of the maintenance. In the past we have constructed roads with the proceeds of county or district bond issues, mainly predicated on real estate values. This was the old idea of making the local people bear all the cost. In recent years we have begun to get away from that policy, raising annually, a small state fund, by the collection of a license fee from the owners of motor-vehicles. It is small indeed compared to the huge bond issues voted by the counties, since the establishment of the State Highway Department, and also compared to the almost incalculable benefits received by the automobile owners from the improved roads.

A National Problem

Our National government has adopted the policy and principle of aiding the states in the construction of state systems on the theory that it is a general public benefit, based also on the idea that the States in turn, taking the same view, would provide state funds to match the Federal money. Texas to date has not done this, but we have now come to the point where we will be compelled to do so, if we ever expect to see a state system, and if we continue to receive our portion of the Federal road appropriation.

In the construction of roads in the past, the burden placed upon the owners of real estate, was perhaps justified. But the advent and rapid growth of the motor vehicle industry no longer justifies a tax on real estate, except to the extent that the owner is benefited.

However, to place the entire burden upon the user of the road would appear to be altogether unjust and unfair. Capital should bear its part of the cost of the improvement. Agriculture should pay only in the proportion to the benefit it gained. Commerce should pay its proportionate share, and finally the users of the road, including the capitalist, the manufacturer, the merchant, the farmer and above all, those who are commercializing the roads for private gain, should all bear their part of the cost.

In other words it would seem that the more equitable way of solving the problem would be to divide the cost fairly between those receiving the benefits of the earning capacity of the road. No road that does not return a fair interest on the investment is an economical or sound proposition. Its cost is indefensible. In measuring the earning capacity, that is, an adequate return on the cost of the improvement, one must not fail to include the additional advantages afforded better educational facilities, the happiness and contentment of our people, all most important factors for the cnosummation of which no price is too great.

Ten million six hundred and twenty thousand four hundred and seventy-one motor vehicles were registered in the United States on July 1, according to the U. S. Bureau of Public Roads.

There are 2,500,000 miles of rural highway in the United States.

Subgrades and Subgraders

By R. B. GAGE

It has been quite definitely determined that the life of most surface pavements is shortened very much by an improperly prepared or unstable subgrade. Since the manner in which subgrades are prepared and the materials of which they are composed usually govern their stability to a great extent, it naturally follows subgrades will vary in both character and stability. In localities where the sub-soil is of fairly uniform composition, the subgrades should be quite uniform in character and stability. The uninitiated might assume that such would be the case, but unfortunately there appears to be more of a variety of "subgraders" than sub-soils. Experience usually is required for perfection. Consequently, some "subgraders" who have had years of experience in road construction have become so expert that they can usually detect a variation of ¼ in. in a subgrade surface from that specified without having to use a template or a straight edge. Such have been their claims and, the department previously experienced some difficulty in determining the thickness of concrete surfaces and foundations.

Fortunately, the uncertainty regarding the thickness and quality of concrete surfaces and foundations was eliminated by the purchase of a Calyx core drill. With this equipment, it is possible to easily cut a core from a concrete pavement or foundation that permits the determination of both the thickness and the quality of the concrete. It was soon discovered that something more than assurance was necessary to properly prepare a subgrade and that the department had in a few cases paid for a greater thickness of concrete than was constructed, also that in some cases an excess thickness of concrete over that required was constructed at points where there was no justification therefor and had to be used in order that the surface of the concrete would have the required grade. The extra concrete thus required usually cost the contractor much more than the amount saved by the methods followed in constructing the subgrade.

Mechanical Subgrades

It was soon noticed that on those jobs where a mechanical subgrader was used the concrete generally had the required thickness at all points, also that the departures from the specified thickness were generally less than ½ in.; consequently, the pavement could be approved as having the average thickness specified when the same was determined from the cores cut from the pavement.

The writer is of the belief that a mechanical subgrader should be specified to be used on each job if possible, for it not only assured that the subgrade will be excavated to the required depth, but also produces a more uniform surface on the subgrade and, as previously stated, effects quite a saving in the quantity of concrete required. Some contractors, however, do not believe that a better surface will be constructed on a subgrade by the use of these mechanical subgraders than can be constructed without them, also that the expense incurred for the purchase and the operation of this equipment is not justified by the results secured. Similar objections have been made against the use of other improved types of road building equipment when

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Abstracted from "The Highwayman."

such equipment was first brought into the market, yet in a short time it was usually noticed that this improved equipment is in general use by almost all contractors. It is seldom that a contractor will not change his mind when he sees that a greater profit can be made by such a change.

In view of the severe strain to which pavements are now subjected, it becomes of the utmost importance that a pavement or foundation has the required thickness at all points, otherwise failures are liable to occur at the thin places. Some of the premature failures in concrete pavements investigated have been found to be caused directly by the concrete not having the required thickness at the point where the failure occurred; consequently, the subgrade should be so prepared that these thin understrength places in the concrete will be eliminated.

In the past, the department has paid the full contract price for pavements or foundaitons, and assumed that

(Continued on Page 7)

How Good Roads Are Developing My Community

By KARL G. PEARSON

Member, Junior Class, Eastern High School, Washington, D. C.

The following essay was chosen as the best of approximately 250,000 papers submitted in a contest conducted with the co-operation of extension divisions of state universities and state departments of public instruction. The scholarship, given annually by H. S. Firestone, Akron, Ohio, for the best essay on a subject pertaining to good roads, provides tuition and all reasonable expenses during four years at college, and is the greatest single educational award offered in the United States. It is valued at not less than $4,000.

Mr. Pearson's essay was chosen by a process of elimination, the three best from each high school in the United States and territorial possessions being submitted to the respective state organizations conducting the contest in co-operation with the Highway Education Board. These institutions chose the best essays from their respective commonwealths, awarded state prizes of their own, and submitted the best essay from each state to the Board in Washington. Dr. John J. Tigert, United States Commissioner of Education, and chairman of the Board, named three national judges to review the state manuscripts, and to award the scholarship. The national judges were: Honorable Henry C. Wallace, Secretary of Agriculture; George Horace Lorimer, editor of the Saturday Evening Post, and Dr. John Grier Hibben, President of Princeton University.

FIVE years ago the little flag station of Buckton lay unnoticed at a point on the railroad where the Blue Valley makes a wide sweep westward. A freight car, carelessly planted by the track, served as the railroad station. All business of the place was transacted in a little frame building, entered by three wooden steps and a stoop out of plumb with the rest of the structure. This was Bucktons' postoffice, grocery store, drug store, and clothing store, all in one. Here the farm hands got their chewing tobacco, and here folks of leisure came to talk a while, after they had been down to see the train pass by. As a steep-banked creek made it difficult for the upland farmers to reach Buckton, they traded mostly at a point five miles further north. The roads from the other direction were possible only at uncertain periods, for after every shower the clay softened into sticky and which made the farmers prefer hte fifteen miles to Summerville, rather than to slump through four miles of mud to Buckton.

However, the same kind of mud produced excellent corn and plump wheat, hence good money when the produce got to market. But it produced also rank weeds along fences and bridges, and often in the tilled fields. In other respects, too, things were allowed to take their own course around Buckton. Bill Tilford, seized by an improvement impulse, remarked, "They're havin' a 'spruce-up' week in Summerville; guess a spruce-up week here wouldn't hurt us none." "What's the use?", retorted Steve Blue, "nobody travels these roads for sight seeing."

But Senator Sheffield had good ideas as well as the less usual ability of putting them into practcie. A ranch owner of the uplands led with a good roads subscription of $5,000; farmers' club subscribed $5,000; and the total amount was completed by a levy on farm lands in proportion to their nearness to the projected new road. And so construction on a hard surface road to tap both the uplands and the valley. Senator Sheffield insisted on "no cheap work or skimping in this enterprise." The road was built with rock and concrete capable of sustaining the heaviest truck loads. The railroad company, foreseeing local progress, removed the ramshackle freight car, and put in its place a suitable depot. An up-to-date garage and a filling station seemed to spring up over night. With the prospect of a good road to their railway station, the farmers built an elevator to save hauling the season's yield the ten or fifteen miles to Summerville.

At the school meeting in August, Buckton was chosen as the site of the consolidated school for six adjoining distircts. "This is the place," so went the argument for the proposal, "for the youngsters can get here, and not muss up the rooms with muddy feet; and if they've got too far to walk, we are now in a position to run a bus line for them."

To the general question, "How is Buckton?", Steve Blue now answers, "Oh, things are movin, and if you don't believe it, just look down the road."

People living miles away make the detour to reach Buckton for it has become a live trading point, and they enjoy the feel of riding along the smooth surface of its thoroughfare. Summerville picnic parties have discovered delightful camping grounds along the road where it sweeps around the bend outside of town. Jim Sharp is setting a new pace for his neighbors by cutting his weeds, and trimming his hedges, and painting his houses and barns. "So many people are coming by that these improvements," he claims, "are called for by common decency."

The new real estate office in Buckton has statistics on economic gains in so far as these are reflected in the sale of farm lands, and town lots. But the chief gains, the social and spiritual ones, cannot readily be expressed in statistics.

Current Events in the Field of Highway Engineering and Transport

IOWA BUILDS 1069 MILES OF PERMANENT GRADING, 432 MILES OF GRAVELING AND 101 MILES OF PAVING DURING 1922

Despite Late Start and Considerable Loss of Time and Delay Road Builders Almost Equal 1922 Program.

Iowa road builders in 1922 built 101 miles of paving, 432 miles of graveling and 1069 miles of permanent grading. This was the record made from December 1, 1921, to December 1, 1922, and will stand, with the eception of gravel road construction, as the record for the year 1922. While all other types of construction were either competed or jobs shut down at least by December 1st, road graveling will continue, in many sections of hte state, with more or less activity during the entire winter.

The 1922 contruction record did not quite equal the program laid out at the beginning of the year. The plan called for approximately 100 miles of paving, 500 miles of graveling and 1500 miles of grading. Paving was exceeded by 1 mile, graveling will probably come very close to the figures planned but the road grading, in point of miles, falls considerably short. There were, however, 3,000,000 yards more moved in 1922 than in 1921. This was due to the fact that on many sections of the road the general average of excavation, per mile, was considerably more than the previous year. Approximately the same average mileage in 1922 would have totaled easily 1500 miles.

Construction work, even on contracts which were carried over from 1921, started rather unusually ate. This was due chiefly to weather conditions during the early spring months. Another feature which slowed up road work during the season was the feeling on the part of the boards of supervisors that public sentiment, during the early months of the year, did not warrant them in leting extensive road building contracts. Many contracts which otherwise would have ben let during the winter were not put up for leting until spring and even some during midsummer. In fact, there are stil nearly 400 miles of road plans in the various county offices on which boards of supervisors have not felt justified in going ahead with the holding of lettings.

Building conditions during the year have been favorable except in the case of railroad transportation. Labor of practically every kind was plentiful at all seasons, except during the few harvest weeks. Contractors experienced some difficulty during this period to get men enough to work to the best advantage. Materials have been plentiful but nearly every large contracting organization, especially on hard surfacing work, was forced to shut down considerable periods for lack of transportation of materials. Quite a bit of the work carried over this year for completion next year is due to the fact that ransportation could not be secured for the materials necesary Prices during 1922 on al classe of work were lower than in 1921 and in many cases were approximately the pre-war contracts.

On December 1, 1921, there was work under way on 151 projects in 92 counties. On December 1, 1922, there were 151 active projects in 77 counties. During the season 105 individual projects were completed and retired in 69 counties. To date there have been 160 projects completed and with the 152 active projects, the grand total of projects on the primary system has been 312.

COLORADO COMPLETES ELK RIVER ROAD

A splendid new road has just been completed by the Colorado Highway Department out of tSeamboat Springs. It runs from the Soda Spring in Steamboat to the Mad Creeek bridge on Elk River.

While only 6½ miles in length ,the road is most important from the standpoint of the ranchers served by it. The road was constructed with Federal Aid funds.

The Northwestern Construction Company had the contract, which was awarded a little over a year ago. Formerly the road was known as the Steamboat-Clark post road. The amount of the final estimate wos $68,778.17.

By action of the county commissioners $30,000 will be available for new construction on state highways in Routt county in 1923. This sum will be spent on the road from Rabbit Ear Pass through Steamboat, Mount Harris and Hayden. Half of the money is subscribed by the county and the balance by the state.

The road to be improved is a part of the Voctory Highway.

KENTUCKY COURT OF APPEALS RENDERS DECISION ON SIMMONS BILL

The Simmons road department reorganization bill passed by the 1922 General Asembly if Kentucky, was declared unconstitutional by the Court of Appeals on the ground that the legislature did not have the authority to name the members of the road commission created by the act. Judge Clay wrote a dissenting opinion, upholding the validity of the act.

The opinion which wa written by Judge Thomas stated that "it was incompetent for the legislature t oname in the tct, or subsequently elect, the members of the State Highway Commission created thereby whose duties are strictly and essentialy executive or adminitrative, the latter of which is a part of and belongs to teh executive department."

The opinion declared that the legislature may perform al legislative acts not expressly or by necessary implication withheld from it, but it may not perform or undertake to perform executive or judicial act except in such instances as may be expressly or by necessary implication directed or permitted by the constitution of the state. To adopt the latitudinous construction that the legislatture may do anything not expressly or impliedly prohibited by the constitution, would to our minds, at once destroy the separation of the powers of the government into the three great departments.

If the act were constiutional and the legislature had the right to name the officers then that body could elect other officers in the state government, members of the tax commision, officers in the Geological Survey, the Insurance Department, county superintendents and others, the opinion held. Judge Thomas then pictured a legislative oligarchy in which the patronage and control of the greater part of the functioning agencies of the state were in the hands of representatives sent from the counties to run the government. It was to prevent such a situation that the constitution was framed, he said. "It is unnecessary iun thi opinion for us to determine where or in what department the power to elect or apoint the officer should be lodged by the Legislature, since in this case it atempted to lodge its nowhere, but to exercise the right itself, which we hold it did not possess,' the opinion stated.

ST. LUCIE COUNTY, FLORIDA, CONCENTRATING ON GOOD ROADS

Construction Work on Highways Is Being Pushed—Cross-State Trail to Tampa to Reach Fort Pierce.

St. Lucie county, Florida, is keeping pace with the demand for good roads. More money was appropriated and spent b ythe county in the last two years for improvement, upkeep and addition to its roads than ever before in its history. Sr. Lucie county now compares favorably with other counties of the state in its mileage of roads in good condition and in the future Fort Pierce is to be the point of junction of a Tampa-cross state highway with the Dixie Highway.

The most imuportant recent work of the county in highway improvement was the resurfacing and widening to 16 feet of the 32-mile stretch of Dixie Highway which extends from Vero to Stuart on the north boundary of Palm Beach county.

But the two big things that will stand out above the past accomplishments in county road development will be the completion by state-federal aid of the 15¼ miles of Dixie Highway extending from Vero to the Sebastian River at the county's northern boundary, and the completion of the Fort Pierce-Okeechobee-Tampa road which latter will throw this section into direct and easy access to the west coast region.

Contract for constructing 7¾ miles of the state-federal aid portion of the Dixie Highway from Vero to Wabasso was recently awarded the F. P. Maule Paving Company. The Maule bid was $237,578.37 for clearing ,hard surfacing and asphalting the road from Vero to Wabasso. This big improvement has been looked forward to eagerly by the people of the county for the past several years and when it is finished the Dixie Highway will extend clear across the county in an unbroken sheet of broad hard surfaced roadway.

BIG PAVING PROGRAM AT FARGO, NORTH DAKOTA

With nearly 16 blocks of paving laid in Fargo, N. D., during 1922, at a cost of about $67,698, and tentative plans to lay seven and one-third miles this coming year, the total paving of that city will be brought to nearly 40 miles ,at a total cost estimated at $550,000. The total sidewalk mileage in that city is now 77.8 miles, and total cost of sidewalk building there has been $22,695.32.

NEW PITTSBURG ROADS TEST UNDER WAY

What promises to be the most important investigation of road material and construction yet undertaken, will be instituted at Pittsburg, California, by the U. S. Bureau of Public Roads, according to a recent statement by Dr. L. I. Hewes, Deputy Chief Enginer of that Bureau in San Francisco. These tests will be based on results of previous investigations at Pittsburg and on the Bates Road tests in Illinois.

Dr. Hewes states that several wholly new scetions will be studied in the new Pittsburg Test, and that these will include asphaltic concrete designs and also precast slabs of concrete.

SURPLUS ARMY SUPPLIES AID STATES IN ROAD BUILDING

Approximately $190,000,000 worth of road building machinery, and other supplies from the surplus war material of the Army, including 30,000 motor vehicles, have been allotted by the U. S. Bureau of Public Roads. This material, of which approximately $150,000,000 worth has been delivered, says the bureau in its annual report, has enabled many of the states to organize and equip maintenance divisions to patrol the entire state road system.

The largest item of materials delivered consisted of shop machinery and shop tools and equipment. This enabled the state highway departments to equip shops for reconditioning and repairing motor vehicles and other motor-driven machinery received from the Government. The shop machinery consisted mainly of lathes, tool grinders, milling machines, cutting machines, planers, drill presses, and electric motors.

Approximately 8,000,000 lbs. of picric acid have been distributed for road-building and land-clearing purposes. In addition to the material distributed from the excess stores at camps and arsenals in the United States, there are now being returned from Germany and France 150 motor trucks, 23 Cadillac automobiles, and 3,000,000 lbs. of spare motor-vehicle parts, shop machinery, and machine tools.

INDIANAPOLIS PATCHES ROADS WITH OLD ASPHALT

Indianapolis is utilizing old sheet asphalt for making patches. The following details regarding the method are supplied by J. L. Eliot, city civil engineer:

"The old material when removed from the street, if still in 'live' condition that is, containing enough oils—placed in a suitable kettle, after having been broken up, and boiled in just enough water to soften the mixture to a point where it may be used. The mixture is boiled long enough to drive off all the water, which sometimes requires only one-half to three-quarters of an hour. The remaining plastic mass is tamped back in the old patch after the base and sides of the old pavement have been properly painted.

"Some of the patches made this winter have ironed out until at the present time it is hard to distinguish them from the original street. With the present method we are employing I have not recommended this type of work for more than small patch work, but believe that with a little development it will be possible to do a great deal of the aphalt patching by this method, and thus leave the present hot asphalt plant free to do larger work."

LEE HIGHWAY CONVENTION POSTPONED

The Lee Highway Convention which had been planned for January 18-20 has been postponed to February 8-10 as the earlier date conflicted with the American Road Congress meeting in Chicago.

Unusual interest centers in Little Rock Convention this year because of the fact that its principal object is to call attention to the fact that there is a comparatively small mileage of road to construct in order to extend the pavement of Washington, D. C., to connect with the pavements of Southern California at San Diego, and to arrange a construction program whereby the few remaining gaps can be let to contract the first date possible, thus securing by Christmas, 1924, continuous pavement connecting the Atlantic with the Pacific seaboard through the South.

The Lee Highway Convention which youngest among organizations working for the development of a particular road. Though it has been functioning less than three years, it has taken front rank and demonstrated the value of organization in such matters. A feature of the work of the Association is that its policy is to designate but a single line. Many organizations have been weakened, and some destroyed, by designating main lines and branch lines. There is plenty for an organization to do in hastening the construction of a single road interstate in character without dividing its interest, dissipating its energies and arousing jealousy in its endeavor to serve communities along lines necessarily competitive.

Keen competition is developing between the several Lee Highway States as to which will have the honor of being the first to complete this memorial to the great Southerner. The California section from San Diego to Yuma is mostly finished, construction being under way or contracts let for all except 9 miles across the sands between Yuma and Holtville, this section being planked and usable. Arizona will furnish the road from Yuma to Phoenix this year. The highway is completed from Phoenix to Globe, and much of it from Globe to the New Mexico line near Duncan. The work has reached an advanced stage in New Mexico, Texas, Oklahoma, Arkansas, Mississippi, Alabama and Tennessee. The State of Virginia must look to its laurels in this competition. The State has established Lee Highway by Act of the legislature and pledged early completion of all unfinished gaps in the 412 miles across the State, and this as Virginia's part of the national memorial to General Lee. It would be a national surprise if the State Legislature which has been called in special session February 28 should fail to pass the proposed $12,000,000 State Highway Bond issue and thus make it possible for Virginia to be the first to finish Lee Highway across a state.

MICHIGAN AND WEST VIRGINIA HIGHWAY CONTRACTORS ORGANIZE

On December 8th, 1922, the Michigan Road Contractors 'Association was organized at Lansing with forty-four charter members. The following officers were elected:

L. D. Townsend, Lansing—President.
Wm. H. Ryan, Jackson—Vice-President.
C. A. Handyside, Detroit—Treasurer.
H. A. Hoxie, Grand Rapids—Director.
Manley Osgood, Ann Arbor—Director.

A temporary organization was recently effected by the Highway Contractors of Wes Virginia, and another meeting will be held in the latter part of January to launch a permanent organization.

DELAWARE HIGHWAY DEPARTMENTS OBTAIN FUNDS FROM MOTOR FEES

The State Highway Department of Delaware obtains almost its entire income from motor vehicle fees, the only additional income last year having been $49,000 appropriated by the State Legislature.

The state highway system has cost up to date $10,862,000 and includes 263 miles of road. Of this amount $7,450,000 has ben paid from state and county funds. It is estimated that double this amount was spent in one year for automobiles owned by citizens.

Davison county, S. D., spent approximately $53,000 on road construction and road maintenance during the past season, according to records in the office of W. O. Crampton, county auditor.

ROAD BUILDERS' EXCHANGE

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1 Haiss wagon loader, gasoline driven.
1 Erie, type "B" combination crane and shovel.
3 75 H. P. locomotive type boilers, on skids.
1 100 H. P. locomotive type boilers on skids.
1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.
1 7x10 Lidgerwood DC DD hoist and boiler.
1 7x10 Lambert DC DD skeleton hoist.
24,000 ft. Lakewood 24 in. ga. 20 lb. portable track, 15 ft. sections, with turnouts complete.
50 Batch box cars and 30 cu. ft. batch boxes.
4 6 ton, 24 in. ga. Whitcomb locomotives.
4 6 ton, 24 in. ga Cummings locomotives.
2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.
1 Foote Paver, Shop No. 1484, self-propelling, steam driven, 2-bag batch; overhauled ready for work.
1 14-E Rex Paver, caterpillar traction.
1 No. 11 Koehring Paver, wheel traction.
3 Lakewood sub-graders.
1 7 ton guy derrick, 70 ft. boom.
1 7 ton stiff leg derrick, 60 ft. boom.
5 Lakewood finishing machines, 16 ft., 18 ft. and 20 ft.
1 10 ton Buffalo-Pitts steam roller.
1 10 ton Austin gasoline road roller.
1 Derrick car, 8 wheel, M. C. B.

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OFFICIAL PROPOSALS

HIGHWAY WORK

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M., on Wednesday, February 7, 1923, for the improvement of highways in the following counties:

COLUMBIA.............(one highway: 2.70)
DUTCHESS.............(one highway: 1.33)
ERIE...........(two highways: 6.61 & 4.84)
HAMILTON...........(one highway: 10.07)
SARATOGA.....(two highways: 0.08 & 0.11)
SCHUYLER.............(one highway: 3.47)

Also for the reconstruction of the following:

FULTON................(one contract: 1:50)
GREENE................(one contract: 3.88)
MONTGOMERY........(one contract: 4.00)
SARATOGA.............(one contract: 4.24)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the division engineers in whose division the roads are to be improved or reconstructed. The addresses of the division engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
Secretary.

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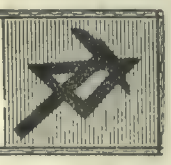

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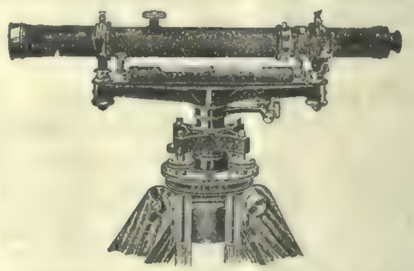

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Motor Truck Traffic on Highways

(Continued from Page 29)

We are informed that between Fort Worth and Dallas 2500 passengers are carried each dayby jitney or busses which must necessarily reult in a heavy financial loss to the railroad and interurban lines between those two cities, which railroads and interurban lines nevertheless contributed to the cost of building this highway.

Between Brady, Texas, and San Antonio jitney lines are carrying passengers at less than one-half the rate it would cost to go by railroad to Fort Worth and thence to San Antonio and it only takes eight hours by the auto whereas 24 hours are required to make the trip by rail.

We realize that our whole system of transportation is in a more or less transition stage, but we believe that the railroads have been of greater value in developing the agricultural, manufacturing and mining resources of our country than any other one factor and their continued operation on a paying basis is essential to the very life and prosperity of our people. We also believe that the auto has come to stay and that the proper use of the motor truck is going to aid very greatly in the future development of our state.

It seems to us that both railroads and motor trucks have certain special functions to perform and there appears to be no reason why these functions cannot be performed without conflict and moreover to the mutual benefit of each other. We believe that to a large extent railroads should use motor trucks and especially desire to call attention to the fact that in Cincinnati railway terminals rae bunched, yet owing to trackage congestion, an average of two days and fourteen hours used to be required to move a freight car a few miles between stations. Now similar distances are covered in fourteen minutes by fifteen five-ton trucks, which transfer freight from terminal to terminal.

The trucks also tap the suburbs, bringing in freight in ample time for daily distance shipment in bulk, saving anywhere from one to four days. Every freight house has standard truck bodies which attach to the chassis. When the railroad cars come in, the freight is quickly snatched from them and allotted to bodies destined for the various stations. Only fifteen minutes is consumed in taking off one filled body and putting on another.

Many items of cost inseparable from railway freight can be eliminated when shorthaul shipment is made by truck. Included in these are items of boxing, crating, demurrage charges, teaming between terminal points, increased weight caused by boxing nad much incidental labor and clerical work in connection with billing checking, tracing, etc.

And finally we must bear mind that our ability to build highways is limited and that we cannot and must not permit trucks to destroy the highways which have been built at such great costs. We also believe that a complete system of highways properly designed, constructed and maintained will greatly tend to develop the agricultural and mineral resources of the state and will thus indirectly cause a larger yield in the revenues of the railroads. It is essential, however, that we recognize the policy of "Live and Let Live" and that both railroads and highways must be recognized as essential portions of the general transportation system of our country.

Subgrades and Subgraders

(Continued from Page 3)

they had the required uniform thickness and strength. The core drill has shown that concrete pavements or foundations seldom have the required minimum thickness at all points unless a mechanical subgrader has been properly used. The department should not pay the full contract price for defective work of this kind and, unless the defect is very serious, it is recommended that pavements or foundations which are slightly deficient in thickness be accepted and paid for at a reduction in price or, in other words, at what the pavement is really worth to the state. If this method of paying for defective pavements was used, it is safe to assume that the penalty thus imposed for inefficient work would amount to much more than the cost and operation of a mechanical subgrader; consequently, the objections which have ben raised against the use of the mechanical subgrader would be automatically eliminated.

In recommending the use of a mechanical subgrader, teh fact should not be overlooked that n certain twpes of work these subgraders cannot be economically operated. If the contractor is permitted to deposit the materials required for the concrete upon the subgrade, this fact prevents the economic operation of a subgrader, also on jobs where the pavement is less than eighteen feet in width or where only one-half of a pavement is constructed at a time, a mechanical subgrader cannot be economically used on account of th elimited width of the workable space on the subgrade.

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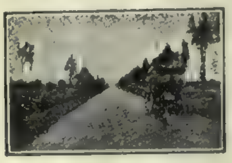

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American Road Builders' Association Hold Most Successful Convention in History of Organization

Thirteenth Good Roads Congress in Chicago a Notable Event—Technical Sessions Bring Forth Papers of High Quality—Exhibits of Machinery and Methods Show Development of the Art

THE Thirteenth American Good Roads Congress held in Chicago from January 15th to 19th under the auspices of the American Road Builders' Association can justly be chacterized as the largest and most successful in the history of the organization. Over 500 delebgates representing practically every state in the Union participated in the technical sessions while many times that number viewed the machines and equipment on exhibit at the Good Roads Show. As announced in the issue of January 10th a change was made in the method of conducting this years convention the technical sessions being held at the Congress Hotel and the Good Roads Show itself in the Coliseum and Annex. As was anticipated this arrangement was most satisfactory and was a large factor in the success of both convention and show.

The Opening Session

The opening session of the Congress was held on Tuesday morning, T .J. Wasser, State Highway Engineer of New Jersey and President of the American Road Builders' Association, presiding. Mr. Wassers' address "Highways-Their Uses and Abuses" sounded the keynote of the Congress and may be considered in the light of a program the accomplishment of which the Road Builders of America must undertake if our national highway system is to develop and become of service to the entire country. Because of its importacne we presnt Mr. Wassers' address in full in the issue.

Papers were also presented by C. M. Upham, State Highway Engineeer of North Carolina; C. Coykendall, Assistant Chief Engineer, Iowa Highway Commission; H. E. Hilts, Acting Chief Engineer Pennsylvania State Highway Department, and W. K. Hatt, Director Highway Research Committee, National Research Council. Abstracts of all of these papers will later be presented in the columns of "Good Roads" and a review of them will therefore not be made at this time.

The afternoon session of the opening day of the Congress was given over entirely to the subject of the design of roads. Six papers were presented, three of which dealt with the topic of road tests. Clifford Older, State Highway Engineeer of Illinois, told of the Bates road tests and how a new pavement design for Illinois has beeen the result of this particular piece of research. Lloyd Aldrich, a consulting engineer of San Francisco, described the method of conducting the Pittsburgh road tests illustrating his paper by moving pictures. The Arlington tests were explained by A. T. Goldbeck, Engineer of Tests, U. S. Bureau of Public Roads. "Good Roads" will also present in its future issues abstracts of all of the papers presented at this session on design, as well as those presented at the other session held during the course of the Congress.

Construction and Maintenance Sessions

The construction and maintenance of roads was considered at two sessions held on Wednesday. At the construction session three papers were presented on haulage, one by A. J. Parrish ,treating of industrial railways; another by Charles H. Fry treating of heavy truck haulage, and the third by A. E. Horst covering light truck haulage. The equipment and operation of local gravel pits was discussed by H. E. Kuelling, Construction Engineeer of the Wisconsin Highway Commission, while H. K. Davis presented the results of a study concerning the amount of time lost in delays in highway building. "What Road Building Work Can Be Done in Winter" was covered in a paper by John H. Mullen, Chief Engineer of the Minnesota Highway Department.

The maintenance problem was presented in a series of five papers. The organization of the maintenance system employed by North Carolina, experiences with patrol maintenance in Wisconsin, and maintenance practices in Michigan, Iowa and Pennsylvania, were each covered in considerable detail by engineers and representatives of the various states enumerated.

(*Continued on Page* 38)

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Good Roads Show Brings New Machine and Equipment

Chicago Coliseum Crowded with Over 200 Exhibitors

THE Fourteenth American Good Roads Show which was held in conjunction with the convention of the American Road Builders' Association in Chicago, January 15th to 19th, presented to the attending engineers, contractors, state highway and federal officials the last word in the design and progress made in the development of road building machinery and equipment. Over 200 concerns displayed their equipment and so great was the demand for space that they were forced to limit the exhibits. Many others were unable to exhibit because of lack of space.

The show this year was an assured success from every angle. The big machines were housed in the main building, and the gallery carried the smaller exhibits. The Annex and the Greer Building also housed the more heavy machinery, while upstairs in the Annex Ball Room there were about 90 booths, occupied by manufacturers of products used in the road building industry, by publications, associations and others.

No phase of the great road-building game was neglected by the 1923 show. There were a number of new machines and new improvements in many of the older ones over which will increase their efficiency. All in all the show marked an important mileestone in the development of America's gigantic highway program.

In "Good Roads" for January 10 will be found a list of the exhibitors at the 1923 Good Road Show and their places of business. In this issue there follows immediately below a list of the various machines and products exhibited. The two taken together therefore constitute a condensed catalogue of road building machinery and materials.

American Cement Machine Co.—Special road builders' rubber tire outfits in new all steel model and light "Handy" outfit; also dump bodies.

American Steel & Wire Co.—Reinforcement for concrete roads, triangle mesh and electric welded reinforcement.

American Wood Preservers' Ass'n.—Creosoted guard rail posts, model of standard creosoted highway bridge, sections of treated piling, bridge timbers, etc.

American Vitrolithic Co.—Machines for compacting and tensifying concrete.

The Asphalt Ass'n.—Models showing steps in construction of various types of asphalt pavements, samples of payements, charts, photographs, etc.

Autocar Sales & Service Company.—Heavy duty truck, dumping mechanism, special contractors' body, various units.

Avery Co.—Avery truck runner tractor. Avery one-man power lift "Road Razer" and the new improved Avey 10-ton oad oller tractor.

Austin-Western Road Machinery Company.—Motors and steam rollers with scarifier attachments, tandem motor rollers, blade graders, jaw crushers, rip snorters, plows, scrapers and culverts. hoists.

J. D. Adams & Co.—Various road graders.

Aldrich Pump Co.—Three units of contractors, portable triplex pumps of single acting outside packed plunger type.

American Production & Trading Co.—Dump bodies, industrial railawy cars and batch mixers.

American Tar Products Co.—Samples of paving and patching grades of Tar-Mac and literature covering its uses.

Anthony Co., Inc.—Reinforcement for road construction.

Archer Iron Works.—Archer "speedmobile" mixer for attachment to Ford truck chassis.

Acme Road Machine Co.—Four cylinder gasoline roller and complete line of graders.

American Manganese Steel Co.—Model of centrifugal sand and gravel dredge pump, manganese steel Missabe dipper and teeth, chain sprockets, elevator buckets, wheels, sheves, etc.

American Willite Co.—Samples of Willite pavement.

Asphalt Products Co.—Samples of expansion joints.

Asphalt Products Association—Samples of asphalt paving.

Austin Machinery Corporation.—Paver.

American Bolt Co. ABoss Nut Division)—Bolts, nuts, rivets.

Automotive Utilities Corp. of America.—Trail truck, gravity dump body, wheel equipment for truck.

Barnes Manufacturing Co.—Road builders' dual triplex pumping plant, road builders' quadruplex pumping plant, duplex pumping unit for smaller road job, plunger trench pump, dual trilpex road builders' pumping plant.

Baker Manufacturing Company. — Latest models Baker-Maney self-loading scrapers (tractor drawn type), with full equipment for attaching behind tractors as used in dirt moving on road work.

Barber Asphalt Co.—Samples of native lake asphalt and its use in highway construction.

Barber-Greene Co. — Barber-Greene model 42 self-feeding bucket loader and Barber-Greene ditcher.

Black & Decker Mfg. Company.—Truck weighing device.

Blaw-Knox Co.—Sixty-five ton trussed bin Batcherplant, also road, curb and gutter forms, integral curb for pavement and sidewalk forms, ¾ cu. yd. clamshell buckets, working models of Batcherplants of suspension bin and trussed bin type, respectively, working models of various types of clamshell buckets.

Borg & Beck Company.—Mechanical underbody truck hoist and clutches.

Bucyrus Company.—New ¾-yd. 20-B. Bullseye shovels, and motion picture exhibit.

C. B. Best Tractor Co.—Tractors.

Browning Machinery Co. — Hoists, cranes, clam-shell buckets, belt and chain conveyors.

Buda Company.—Engines for trucks, heavy duty jacks, turbo generator for lighting, power unit direct connected to centrifugal pump.

Butler Equipment Co.—Measuring device for sand and gravel.

Edward R. Bacon Co.—Bacon portable car unloader.

Bates Engine & Tractor Co.—Road building tractors of the crawler type.

Beach Manufacturing Co.—Bottomless bucket for operation either dry or below water.

Bear Tractors, Inc.—Gasoline tractor.

Burch Plow Works.—Models of stone unloader and stone spreader and possibly full sized spreader; also rooter and road plows and sections of culvert pipe.

Byers Machine Co.—Full revolving crane gas power, full caterpillar mounting.

Bain Wagon Co.—Draft wagons.

Brookville Truck-Tractor Co. — The Brokville Tractor.

Beaver Manufacturing Co.—Automotive engines for industrial machinery.

Bunting Brass and Bronze Co.—Bronze bushings and bearings.

Central States Engineering & Sales Co.—Hand operated dump body; will be shown mounted on International Harvester truck chassis.

Climax Engineering Co.—Two models of heavy duty Climax trustworthy industrial type engines, and display board of engine parts.

Concrete Steel Co.—Reinforcement for roda construction.

B. M. Cropp Co.—Concrete mixer.

Corrugated Bar Co.—Samples of Corrugated Bar Co. road units and bridge slab units.

Clay Products Association.—Culverts of vitrified pipe.

Chain Belt Co.—Concrete mixers.

Construction Machinery Co. — Small concrete mixer.

Carbic Manufacturing Company.—Carbic acetylene light.

C. H. & E. Manufacturing Company.—No. 9 Triplex pump on truck with canopy top. Four cylinder engine in connection with 40-gal. capacity triplex pump.

Climax Engineering Co.—Two models of heavy duty Climax trustworthy industrial type engines, and display board of parts.

Clyde Iron Works Sales Co.—Double drum, multiple cylinder, gasoline hoist with independent reversible elevator sheave.

F. D. Cumcer & Son Co.—Catalogs and other printed matter on asphalt plants.

Philip Carey Co.—Full sized pieces of elastite expansion joint cut to fit various types of structures, large size sheets of this material.

Domestic Engine & Pump Co.—"Domestic" portable gasoline driven air compressors, "Domestic" portable road pump, diaphragm pumping outfit and gasoline

Dunn Road Machinery Co.—Dunn tamping and finishing machine.

Dunn Wire-Cut Lug Brick Co.—Section of wire-cut lug brick pavement.

W. E. Dee Co.—Sewer pipe, manhole covers.

Eastern Car & Construction Co.—Turntable, up to 3 tons, rollover body, scoop body.

Elgin Sales Corporation.—Motor-driven street sweeper.

Electric Wheel Co.—Four cylinder heavy duty, gasoline and kerosene motor power units.

East Iron & Machine Co.—Model of the improved Merrimca asphalt plant.

E. D. Etnyre & Co.—Model F tar and asphalt distributor, also special contractors' model G, oil heater and distributor.

Erie Steel Construction Company.—Stone, sand and gravel bins.

Erie Steam Shovel Co.—Type B, high lift steam shovel mounted on caterpillar type truck.

Erwin Greer Automobile Company.—Truck and body.

Evinrude Motor Co.—Motors for construction service.

Egyptian Iron Works. — Manhole covers, bridge rockers, bronze plates.

Essco Manufacturing Co.—Mushroom traffic lights and mushroom stop and go systems, including elevated suspended units using colored lenses.

Equipment Corporation of America.—Construction equipment.

Freeman Manufacturing Co — Turntables.

J. D. Farasay Manufacturing Co.—Literature and illustration of asphalt plants.

Fairbanks, Morse & Co.—60 H.P. multiple cylinder engine for dragline and "Z" engine for concrete mixer and auxiliary use.

Fate, Root, Heath Co.—4-ton fritcion and the new 7-ton four-speed gear Plymouth gasoline locomotives.

Federal Motor Truck Company. — Heavy duty trucks.

Four Wheel Drive Auto Company.—Heavy duty trucks.

A. W. French & Co.—Ord concrete road surfacer with motor mounted so that machine can be shown in operation; also No. 7S Orr & Sembower Concrete Mixer and two or more Orr & Sembower gasoline-driven hoisting engines.

Foote Concrete Machinery Co.—A 21E gasoline multifoote paver equipped with brom and bucket in operation.

Fairbanks Steam Shovel Co.—Model K steam shovel.

Full-Crawler Co.—Fordson tractor.

General Motors Truck Co.—Trucks, chassis, one and two compartment dump bodies, hoists and two range transmission.

W. S. Godwin Co.—Godwin steel paving guards shown in connection with all types of paving, curbs, railways, expansion joints.

Good Roads Machinery Co.—Latest models of bituminous distributor, Monarch steam road roller with scarifier attachment, rock crushing outfit and graders.

L. P. Green.—Working models of power drag scraper and cableway drag line excavator.

W. & E. E. Gurley.—Transits, levels, plane table outfits, compasses, leveling and stadia rods, cement meters, water levels and recorders, and similar equipment for highway engineers and surveyors.

Grasselli Powder Co.—Powder.

Heltzel Steel Form and Iron Co.—Steel road forms and tamper.

The Hug Co.—Speed truck, turntable, subgrader.

Highway Trailer Co.—Trailer trucks and dump bodies.

Hercules Motor Manufacturing Co.—Gasoline motors.

Hadfield-Penfield Co.—Fordson tractor fitted with one-man grader, and H-P rigid rail track.

Headley Good Roads Co.—Emulsified-asphalt for repairs.

George Haiss Manufacturing Company.—Large creeper wagon loader with measuring hopper and swivel spout.

Hastings Pavement Co.—Compressed asphalt paving and flooring blocks, samples of different sizes of blocks, ingredients used in their manufacture, model pavements.

The Heil Co.—Steel dump bodies and hoists including partitioned batch bodies, standard body and hoist for batch work, Heil gravity dump body for handling wet mix, new Heil underneath hoist and flat bed body,etc.

Holt Manufacturing Co.—Complete line of "Caterpillar" tractors—T-35, 5 and 10-ton.

The Hercules Corporation.—Gas engines.

C. Hvass & Co., Inc.—Asphalt plants, road oilers, street cleaning machien.

Ingersoll-Rand Co.—Portable compressors, rock drill, pneumatic tools, sand rammers, clay spades, drill sharpeners, pumps, etc.

International Mack Truck Co.—

Indiana Truck Corp.—2½-ton truck.

International Steel Tie Co.—Steel paving guard.

C. L. Johnson Co.—Demountable material bin, automatic measuring hopper.

Jaeger Machine Co.—Small mixers.

Koehring Company.—Two pavers and a crane.

Koppel Industrial Car & Equipment Co.—Multiple batch box unit.

Keystone Driller Co.—Steam shovel.

Kelly, Derby Co.—Portable lavatory.

Kinney Manufacturing Co.—Distributor and road oiler.

Kentucky Rock Asphalt Co.—Rock asphalt.

Kelly-Springfield Motor Truck Co.—Motor trucks.

Lakewood Engineering Co.—Lakewood wood units, narrow gage track, batch box cars, batch boxes, finishing machine, subgrader, grade rooter, road forms and possibly Lakewood clam shell bucket.

LeRoi Co.—Line of heavy duty light weight internal combustion engines.

F. J. Lewis Co.—Derivatives of coal tar.

Link Belt Co.—Crawler crane, swivelling loader, chain and elevator buckets trucks chains, etc.

Line Material Co.—Traffic regulation equipment, traffic lighting fixtures.

Lufkin Rule Co.—Measuring tapes rules, etc.

Moore Brothers.—Locomotive crane, clamshell caterpillar truck.

Mack Motor Truck Co.—Heavy duty trucks.

Mushroom Traffic Light. — Mushroom lights, traffic control system.

Louis Marsch.—Interlocking concrete culverts.

Metal Forms Corporation.—Road forms, steel forms for all types of concrete construction.

Minneapolis Steel and Machinery Co.—Motors for industrial use.

The Marsh-Capron Co.—Low charging concrete mixer, Hotchkiss road forms, sidewalk forms, curb and guter forms.

Maxon Co., The—Pavement tamper and finisher.

Mead-Morrison Manufacturing Co.—Type W lever arm grab buckets together with small 1½ in. scale working models of this grab; also new model electric hoists and vertical capstan car pullers.

Milwaukee Locomotive Co. — Road building locomotives.

Moline Plow Co., Inc.—Tractor works. Road tractor and plow.

Monarch Tractors, Inc.—Tractor for road work and snow removal.

Naitonal Paving Brick Manufacturers' Association. — Pictures, literature and other data on brick paving construction.

National Pavement Corporation. — Samples aid literature.

Novo Engine Co.—Portable air compressors, road pumps, single and four-cylinder gasoline engines, specially designed hoist for gravel pit work, and other outfits.

Northwest Engineering Co.—Northwest ¾-yd. gasoline shovel complete; also accessories for machine.

National Pavement Corporation.—Illustrations, literature, material specimens and accelerated impact test on asphaltic composition pavement.

National Steel Fabric Co.—Various types of welded road fabric.

O'Neil and Day.—Model demonstration of O'Neil process of gravel road construction and rebuilding.

O'Connell Motor Truck Co. — Heavy motor trucks.

The Osgood Co.—Excavating machinery parts, special literature.

Overman Cushion Tire Co.—Cushion tires, including a demountable rim that may be used in mounting any S. A. E. solid or cushion tire to a pneumatic wheel.

Owen Bucket Co.—Clam shell bucket.

O. K. Clutch and Machine Co.—Hoist.

Parsons Company.—Backfiller.

Pawling & Harnischfeger Co.—No. 206, ¾-yd. shoevls, and skimmer boom.

Petroleum Motors Corporation. — Motor.

Pittsburgh Testing Laboratory.—Machine for testing cement portable asphalt laboratory.

Russell Grader Manufacturing Co.—Elevating grader and wagon loader No. 42-C, one-man machine for road patrol, drag line excavator, 32-ft. light weight conveyor-loader and unloader.

Ransome Concrete Machinery Co.—Paving mixers, building mixers.

Safety Traffic Light Mfg. Co.—Complete line disappearing dome safety track lights; also power test machine for showing how dome of traffic light functions when struck by a vehicle.

Sauerman Brothers.—Portable scraper outfit complete, working models of dragline cableway excavator and power drag scraper, and various cableway and scraper supplies and accessories.

Schramm, Chris. D., & Son.—Air compressors and tools.

Smith, T. L. Co., The.—Paving mixers.

Standard Oil Co. of Indiana.—Exhibit of methods and materials used in building asphalt roads.

Sullivan Machinery Co.—Portable air compressors and drills.

Smith Engineering Co.—Model of crushing plant.

Sterling Motor Truck Co.—Heavy trucks.

Seaverns, James B.—Truck loader.

Shaw-Enochs Tractor Co. — Power grader and power scraper.

Sivyer Steel Casting Co.—Steel castings.

Stockland Road Machinery. — Road grader.

Sover Mfg. & Engine Co.—Gasolene engine.

Stroud & Co.—Model of Stroud "Little Red" wagon.

Sidney Steel Scraper Co.—Kost Kutter dumpers

Stoughton Wagon Co. — Stoughton wagons.

Taylor-Wharton Iron & Steel Co.—Andrew gyratory crusher heads, Van Buskirk dipper tooth concaves and jaw plates, chains sprockets, etc.

Thomas Elevator Co. — Two-speed slack line excavator hoist.

Thompson Bros. Co.—Reflecting warning signals known as Redflex, greenflex, and yelowflex signals.

Truscon Steel Co. — Wire mesh for pavement reinforcement.

The Barrett Co. — Asphalt and pavement samples, pictures and literature.

Thew Shovel Co., The—Models, photos, and descriptive matter on Thew power shovels.

Titan Truck Co.—Motor truck.

Charles T. Topping Machinery Co.—Ditcher of pony type.

Union Iron Products Co.—Metal culverts, metal signs, turtle-back pavement light and danger signals.

United Manufacturing and Distributing Company.—Air cleaners.

Waukesha Motor Co.—Gasolene motors for various sirvices.

David White Co.—All necessary instruments for road builders.

Wiard Plow Co.—Plows of various sorts.

Wisconsin Motor Manufacturing Co.—Gasolene motors for various uses.

Wood Hydraulic Hoist & Body Co.—Truck body and hoist on a dummy chassis.

Wyoming Shovel Works. — Hand shovels.

Warren Brothers Co.—Warrinte bitulithic specimens, illustrations and literature.

Williams Patent Crusher and Pulverizing Co.—Rock crushers.

Wellman, Seaver, Morgan Co.—Motors for all purposes.

Watson Products Corporation.—Bottom-dump wagon.

G. D. Whitcomb Co.—Industrial locomotive.

Western Wheeled Scraper Co.—Batch boxes and heavy duty road builders' railway trucks.

Wehr Company. — One-man grader, road maintainer, governor.

Model Highway Exhibits a Feature of Road Show

An interesting feature of the Road Show was a mammoth exhibit by the U. S. Bureau of Public Roads, covering more than 2,000 sq. ft. of space, as well as complete exhibits dealing wtih road construction by several state highway departments, including those of North Carolina, Illinois and New Jersey, and exhibits by the Asphalt Association, the Portland Cement Association, the National Association of Paving Brick Manufacturers, the Associated Pennsylvania Highway Contractors and similar organizations which demonstrated the latest methods involved in laying the various types of pavements.

The exhibit of the U. S. Bureau of Public Roads showed the type of road the Bureau is building in the National forests. The model was 20 ft. in length and represented a section of highway in a typical mountain region. Around the model, as a centerpiece, were grouped a display of illuminated colored photographs, showing federal aid roads in all parts of the country, together with interesting views of the experimental and research work done by the Bureau.

Small models of bridges and roads of various types in course of construction also formed a part of the exhibit, as well as a display of testing apparatus which included a number of new devices developed by the Bureaus engineers. Progress in federal aid road construction was shown graphically by means of numerous charts. The exhibit also included a large assortment of speciment road materials, stereopticon lantern slides and mition pictures of actual road construction.

A. R. B A. Will Return to Chicago for Next Year's Road Show

The board of directors of the American Road Builders' Association has set the place and dates for the 1924 convention and road show. It will be held at Chicago January 14 to 19, 1924. The board of directors has authorized the execution of a lease for the Coliseum for the road show for these dates. The Coliseum company already has agreed to reserve the big exposition building for that time, and the lease will be closed up today.

Negotiations for the convention headquarters are already under way. The board of directors of the association is assured of more satisfactory quarters for the convention, but it is not yet ready to announce its plans.

By making definite arrangements for next year's convention so long in advance all who are concerned in them may have ample time to make their plans for participation. The Association also will have ample opportunity to work out its organization of committees for handling the two big events of the year in the highway industry.

Good Roads Congress

(*Continued from Page* 35)

The last two technical sessions of the convention were held on Thursday afternoon and Friday morning. On Thursday the traffic problem was considered while on Friday finance and miscellaneous topics were discussed. The development of tourist traffic as a factor in high way advancement was discussed by A. B. Hirst, State Highway Engineer of Wisconsin, while J. N. Mackall, Commissioner of Roads of Baltimore, Md., spoke of the changes needed in motor vehicle legislation and license fee systetms and advocated the metering of highway transportation by means of a tax upon gasoline.

On Friday S. E. Brandt discussed the question "Have Large Expenditures Changed the Public Attitued Toward Highway Development?" His conclusion was that as yet there is no need to fear that public support will fail.

Our National Highways—Their Use and Abuse

Presidential Address Delivered before the Thirteen American Good Roads Congress Held at Chicago January 16 to 19, 1923, A Noteworth Message

By T. J. WASSER,

President, American Road Builders' Association

IN selecting the subject for this paper, I wished to present to you what I have observed, investigated and studied for the past eight years, relative to the use and abuse of our highways. It was in 1915, while I was county engineer of Hudson County, New Jersey, that I first took up the subject with Hon. William L. Dill, Commissioner of Motor Vehicles of New Jersey, and stated that it was necessary to have additional legislation to protect the highways from the abuse brought upon them by commercial motor vehicles as they were being operated at that time. The Commissioner immediately appointed a committee, of which I was made chairman, to investigate and report on the matter, and this committee, after a year's work, submitted a report which was immediately incorporated into a legislative bill, introduced, passed, and is at present a part of the New Jersey statutes.

A National Matter

My investigation and studies since that time, and more particularly during the year 1920 when I served as a member of the Motor Traffic Commission appointed by the Hon. Edward I. Edwards, Governor of New Jersey, have convinced me that, due to the growth and development of the motor industry, the fundamental principles involved in the financing, design, construction, maintenance and use of the highways no longer constitute a state proposition, but that it has become a National matter.

Much good work has been done by various individuals and organizations throughout the country looking toward this end. Literature has been published and many articles written, but in nearly every case the author has presented the matter from his viewpoint alone, without giving consideration to the needs of others, and no concerted effort has been made, on broad lines, to bring the several interested parties together The National Highway Traffic Association did attempt this; in fact it held a meeting in New York City, which I attended, and at which the several interests were represented. However, at the end of this meeting, the views expressed were just as far apart as they were before, and they are just as far apart today. My experience in public life leads me to make the following statement. "There is a solution for every public problem if we eliminate the selfish interests involved," and I make that statement as applying to this problem.

Other attempts have been made to reach a satisfactory conclusion by conference, but without success, either in whole or in part. The pamphlet entitled "State Regulation of Motor Vehicle Common Carriers" issued in 1922 by the Motor Vehicle Conference Committee, affiliated with the National Automobile Chamber of Commerce of New York, cites the arguments presented for and against state control of common carriers. That is only one phase of the subject, and a final solution of it was not found by that committee, although state regulation of the automobile carrier is already well established in many jurisdictions.

President Harding's address to Congress under date of December 8, 1922, treated this phase of the subject as follows:

"Manifestly, we have need to begin on plans to coordinate all transportation facilities. We should more effectively connect up our rail lines with our carriers by sea. We ought to reap some benefit from the hundreds of millions expended on inland waterways, proving our capacity to utilize as well as expend. We ought to turn the motor truck into a railway feeder and distributor instead of a destroying competitor.

"It would be folly to ignor that we live in a motor age. The motor car reflects our standard of living and gauges the speed of our present day life. It long ago ran down simple living, and never halted to inquire about the prostrate figure which fell as its victim. With full recognition of motor-car transportation we must turn it to the most practical use. It cannot supersede the railway lines, no matter how benerously we afford it highways out of the public treasury. If freight traffic by motor car were charged with its proper and proportionate share of highway construction, we should find much of it wasteful and more costly than like service by rail. Yet we have paralleled the railways, a most natural line of construction, and thereby taken away from the agency of expected service much of its profitable traffic, which the taxpayers have been providing the highways, whose cost of maintenance is not yet realized.

"The federal government has a right to inquire into the wisdom of this policy, because the national treasury is contributing largely to this highway construction. Costly highways ought to be made to serve as feeders rather than competitors of the railroads, and the motor truck should become a co-ordinate factor in our great distributing system."

I feel that the right to regulate against abuse of the highways, based on fundamental principles, should also be taken into consideration in connection with the solution of "The Problem of Transportation." If this is a matter for Congress to decide let us present the facts at once.

The Problem of Transportation

I have been using the term "highway," and before making specific statements regarding the use and abuse of the highways, I desire to differentiate between the dictionary definition of the word "highway" and the meaning of the word in this paper. Funk and Wagnall's New Standard Dictionary of the English Language gives as the definition of "Highway";

1. A specified line of travel, by land or by water over which a right of easement is enjoyed by the public of freely passing; a public thoroughfare, as distinguished from a private way.
2. In law, a generic name for all public ways, whether by legislation, dedication, or necessity.
3. A main road as distinguished from branches and byways of minor usefulness.
4. A common or open way or course.

In this paper, however, the term "highway" will always refer to a graded roadway of a main public thoroughfare upon which is constructed a durable pavement of sufficient width and thickness to permit of two vehicles of the maximum size carrying the maximum loads permitted by law to pass each other safely and with sufficient clearance at the maximum legal speed.

The highway during its period of construction is the greatest medium through which desirability of equipment, materials, products, and methods that enter into its construction are determined, and records properly and accurately kept during this period are of inestimable value for future consideration.

Experimental road work carried on by a state should be done in conjunction with the Federal Bureau of Public Roads, even though the work is financed wholly by the state. Such a procedure would eliminate much duplication of effort, would lead to the establishment of a uniform system of securing and recording information, and would provide for the dissemination of such data among the other states. It is especially desirable in the case of materials, methods and appliances controlled by their producers that conclusions, based on actual use on experimental sections, be digested and transmitted by the bureau rather than by the agency having a commercial interest in the article.

Abuse of the Highways Prior to Completion

While highway construction is rated as the fifth industry of the United States there is a lack of co-aperation among the several interests involved, with a resulting unnecessary added expense. This can best be corrected by recognizing the several component parts of the industry, and by standardizing as nearly as possible the products used and method employed

There should also be full recognition of the importance of the highway industry by the Interstate Commerce Commission and State Public Utility Commissions in the fixing of equitable freight rates on materials used in highway construction. Reasonable open top car service also should be porvided at times when preference is given to carrying coal. The latter requires intelligent regulation in place of the drastic action that has been experienced in the past few years.

The greatest abuse often comes to a highway before it is built, namely, failure to provide adequate drainage, faulty judgment as to type and width of pavement, and choice of location to suit certain interests.

There are frequently abuses in connection with financing, design, and construction of our highways, some of the more evident of these abuses are:

1. Making the term of bonds longer than the life of a pavement.
2. Failure on the part of the engineer to provide a design and type of construction to meet the requirements of modern traffic.
3. Faulty construction on the part of the contractor for personal profit.
4. Inefficient inspection due to lack of knowledge, and to insufficient salary being paid to attract capable men.
5. Acceptance of inferior work.
6. Permitting inferior material to be substituted for that specified when delays are brought about by conditions beyond the control of the contractor.
7. Sacrificing quality for speed.
8. Failure to provide for a satisfactory well marked and maintained detour during the period the highway is under construction.
9. Designing and building bridges for a live load less than that for which motor vehicles are licensed and narrower than the graded width of the highway.
10. Failure to provide for the elimination of railroad grade crossings.
11. Designing underpasses with a head room less than fourteen feet in the clear.
12. Lack of co-operation on the part of public utility companies and municipalities. The highway departments should advise all interested utility companies and municipalities as soon as a highway project is decided upon, and these interested parties should immediately proceed to perform all necessary sub-surface work thereby eliminating delay in the progress of construction and the necessity for opening the pavement in the near future.
13. Absence of caution on the part of bonding companies. Bonding companies becoming surety for inexperienced persons who are operating under the guise of contractors or construction companies jeopardize the interest of the state engaged in highway construction. They should limit the surety to a fixed amount for the first contract, increasing the surety on the second contract, and so on until the applicant establishes his responsibility for carrying out contracts of magnitude.
14. The tendency of contractors to bid too low. This fault has had more to do with the performance of inferior work than any one other cause, and inexperienced contractors just entering highway construction are chiefly responsible, yet the bonding companies will go on their surety just the same as they will for experienced contractors.
15. Use of inferior material. Competition in manufacturing or producing material used in construction is such that inferior material is frequently put in competition with satisfactory material, and by under selling is used in the work. In many cases where inferior material has been rejected by engineers and officials they have been charged with favoring some particular material or product for reasons other then its merits.
16. It has been definitely determined that excessive use of water in mixing injures the quality of concrete, yet in many cases engineers, contractors and inspectors still permit the use of excess water. The contractor permits it because his force can turn out more work, and he claims it just as good. The inspector tries to remedy matters, but is unsuccessful. The Chief Engineer can not see all the wor, and a subordinate in carrying out his Chief's desires is accused of retarding the progress of the work. However, anything that tends to add unnecessary cost to the construction and maintenance of the highway should be considered an abuse just as much as should a violatio nof the provisions of down to protect it.

All of these abuses should be corrected at once, and the industry protected by the soundest kind of financing, engineering design, faithful construction and efficient inspection.

The use of the highway is very ably defined by quoting from the report of the War Department Claim Board in their reply to the State of New Jersey's claim on behalf of several of its counties, whose roads failed under the conditions exacted by the use of them by army transports during the War period, which reads as follows:

"With reference to your claim, and that of several counties in the State of New Jersey, for compensation covering repairs to roads which were used by government trucks traveling between the different munition plants and camps in said State, you are advised that this Board, after carefully reviewing all the evidence and circumstances in connection therewith, has denied the claim."

The following is taken from report of the Board:

"The roads, even though they were owned and maintained by the counties, were public roads and were open to lawful use by any individual or organization which desired to use them."

"If the power of a state to control its highways has not been delegated and the state has prescribed no conditions limiting or regulating the use of the highway, the people are at liberty to use it for travel, transportation, and communication subject to the condition that such right neither interferes with the lawful uses of the street nor invades the rights of the owners of abutting lands."

The Assistant Secretary of War has approved the findings and recommendations of this Board.

From the foregoing statement it is quite clear what is considered the use of highways. That the road in question failed under army transport traffic is evidence that they were not designed nor constructed to withstand modern traffic. Their failure should not be charged to abuse due to traffic, but should be charged to abuse by the governing body financing, designing, and constructing such roads.

At the present writing I am safe in saying that every state has many miles of such inadequately built roads, the upkeep and maintenance of which is out of all proportion to the service which they render. It is, therefore, necessary that only such highways as are efficiently financed, designed, constructed and maintained be offered to the public for use, in order that fundamental principles may be laid down that will make possible the establishment of regulations for the use of the highways.

Abuse of the Highways After Completion

Abuse of the highways is generally caused by a small percentage of users. Such abuse frequently results in accidents, causing injury and loss of life and destruction of property. Law enforcement alone will not overcome these conditions or decrease the number of traffic accidents. The problem requires: first, adequate traffic planning, and second, proper enforcement of regulation according to the plan.

My deductions have been derived largley from observations of conditions in the more thickly congested sections of the country, and it is quite possible that some modification of my suggestions would be necessary to make them applicable to more sparsely settled communities. However, the fact must not be lost sight of that density of traffic increases rapidly with road improvement, and that provisions must be made for an unanticipated increase. Furthermore, right of way, grading, and major drainage improvements are practically permanent, and should be taken care of, once for all, in the original construction.

It is only necessary to observe the traffic conditions in any of our cities or upon our highways to appreciate the necessity of a wise and equitable policy of supervision. Such a policy must be drawn so as to prevent destruction of life and property.

In order to enable those whose duty it may become to work out an equitable and uniform plan to prevent the abuse of the highways, I recommend:

1. That the minimum graded width of all main high-
   of all vehicles drive to the right.
   ways be not less than 30 ft.
2. That this graded width be kept clear of all encroachments.
3. That all traffic rules be made uniform.
4. That a system of marking one-way streets be adopted, which will be uniform as to type and location of the markers.
5. That it is desirable to standardize all directionary and cautionary signs as to color and marking, and that posting signs other than directionary and cautionary on the right of way be made unlawful, and subject to a fine for each offense.
6. That the erection of signs on property abutting on the highway at curves, railroad crossings and intersections be discontinued, where such signs would obstruct the view of those using the highway.
7. That it is desirable to standardize colors to be used for degree of danger where illuminated signs are used, for instance, red at a railroad crossing or dead ends of highways, green for highway intersections, and amber for grades and curves.
8. That a uniform traffic regulation de adopted for intersecting highways to be in effect in the absence of traffic officers.
9. That a uniform maximum height, width, and length of vehicle be adopted.
10. That a uniform gross weight of vehicle and load for each clas of commercial motor vehicle be established.
11. That all gas filling stations be located on property abutting on the highways, and not on the right of way; and that all gas filling stations shall display a visible tag o neach pump, which shall be placed there by the State Department of Weights and Measures certifying as to the accuracy of said measuring device.
12. That parking of vehicles on both sides of a highway opposite each other, where a minimum distance of 20 ft. between the vehicles is not provided, be considered a nuisance and be made punishable by a fine.
13. That the erection of all booths and stands for the sale of goods within the right of way, and displaying farm produce in containers within the right of way be prohibited, and that the use of vehicles for retailing wares along the highway where such practice would cause persons to congregate on the paved portion be also prohibited.
14. That a uniform penalty for operating a defective motor vehicle on the highway should be provided. It is not the purpose of this paper, nor is the writer qualified to discuss automobile design; however, there is a common defect particularly in trucks, the correction of which would eliminate one source of danger. Tail lamps frequently fail to function due to the wires having been damaged by abrasion or exposure to splashing water. It would seem to be an easy matter for the designer to provide protection for these wires. Other defects that the writer has in mind are broken or improperly adjusted brakes and badly worn tires.

(Continued on page 46)

Current Events in the Field of Highway Engineering and Transport

NORTH DAKOTA GOOD ROADS ASSOCIATION PROPOSES HIGHWAY LEGISLATION

J. E. Kaulfuss, secretary of the North Dakota Good Roads Association, claims that that state can cut her taxation for highways by more than one-half and still keep on building the roads, through legislation which the association plans to have introduced into the legislature during the present session. The plan, brifly, is to do this by shifting the tax burden to the license fees for motor vehicles, which, it is held, can more easily bear the burden, while at the same time the state will be furnished with a strongly centralized highway commision that will be in a position to continue receiving federal aid. This latter will become impossible after 1926, under the present system. It is claimed that $1,500,000 yearly tax reduction will be made possible through the following proposed measures:

1. A constitutional amendment so designed that no future question can be raised as to the constitutionality of legislative acts relating to a state highway commission, state highway system and state highway fund.

2. A state highway commission act to develop the commission as enabled in the constitutional change and make it strong, effective and patterned after the most satisfactory form of commission.

3. A motor vehicle license bill to increase the income from this department about 50 per cent.

DES MOINES-ANKENY ROAD TRAFFIC MORE THAN DOUBLES DURING PAST TWO YEARS

Traffic on the Polk county highways of Iowa has more than doubled in a period of two years, according to figures from a series of traffic counts made on the Jefferson Highway during the past months and compared with similar figures from a count made in 1919. The counts were made each year on the Des Moines-Onkeny road, Road No. 1, just north of Des Moines, in the course of preparing data for the primary system concrete road building job.

The total average vehicles per day in the 1919 count were 879 and corresponding figures in the 1922 counts average 2567. This was a gain of 2.47 times in the traffic during the two seasons.

It is interesting to note the faling off in the daily average of horse drawn vehicles. In 1919 the average for freight and pasenger horse drawn vehicles was 53. This was 6.0 per cent. of the total daily average of traffic on the road. In 1922 the total average of horse drawn vehicles was 35.9 per day and the percentage of such traffic was 0.75 or less than 1 per cent. of the entire traffic as compared with 6 per cent. of the entire traffic in 1919.

Interstate traffic in 1922 averaged 85 care or 3.2 per cent. of the total. Intercounty traffic averaged 539 cars per day or 20.9 per cent. Interstate plus intercounty traffic in 1919 averaged 97 cars per day or 1 per cent. of the total for thta year. The bulk of the traffic was naturally conuty traffic averaging 1944 cars per day for 1922 or 7g.9 per cent. of the total. This same traffic in 1919 averaged 782 cars per day or 89 per cent. of the total traffic.

SHORT COURSE IN HIGHWAY ENGINEERING AT UNIVERSITY OF ILLINOIS

The Department of Civil Engineering of the University of Illinois announces that the tenth annual short course in highway engineering will be held at the University February 19-23, 1923. The State of Illinois Department of Public Works and Buildings, Division of Highways, is actively cooperating in giving this curse. The speakers and leaders of discussion will be taken from the Univerity faculty, the staff of the Division of Highways, and the county superintendents of highways.

The course is open without fee to any person interested. Copies of the program may be obtained by addressing the Department of Civil Engineering, University of Illinois, 201 Engineering Hall, Urbana, Illinois.

IOWA PRIMARY ROAD SYSTEM NOW 55 PER CENT GRADED

Paving Totals 334.4 Miles With 1,558 Additional Graded but not Surfaced Miles of Gravel and 1,761.1 Miles

The condition record of the Iowa Primary System January 1,. 1923, shows 334.4 miles of the system paved, 1,556.6 miles graveled with 1,761.1 miles additional graded but not surfaced with either gravel or pavement. On January 1, 1922, records show the condition to have been 236 miles of hard surfacing; 1,157 miles of graveling and 1,448 miles of grading, unsurfaced with either ravel or hard surfacin.

The difference in these two sets of fiures show the advance in improvement that was made on the primary system during the construction season just past. Road builders will be interested in noting the steady progress which has been made in the nature of per cent of mileage either surfaced with grvel or paved on January 1st of each year. In 1920 this class of improvement showed but 10 per cent, in 1921 this had grown to 13 per cent, in 1922 to 21 per cent and on January 1, 1923, the record shows 28 per cent. In point of percentage of system graded, on January 1, 1922, the records show 43 per cent of the system as having been put to permanent grade. At the end of the past construction season the records stood 55 per cent of the entire system graded.

NEVADA HIGHWAY DEPARTMENT MAKES SURVEY OF OVERLOADED TRUCKS

The Nevada State Highway Department recently completed a series of weight ests on various trucks using the highways in the vicinity of Reno. The tabulated data collected during this campaign presents some interesting information regarding the practice of overloding trucks. From the table appended it will be noted that not only is there serious overloading of the trucks but that the load per inch-width of tire as recommended in a majority of the states has been seriously exceeded in almost every case. The Department in its legislative recommendations specifies a maximum load per inch width of tire of 600 lb. and a majority of the states provide 700 lbs., but it will be noted from this table that the weight in one case reached 1440 lbs., with several others running considerably over 1000 lbs. The weight per inch-width of tire gages the true overload of a truck and should be the basis for determination of overloaded trucks as to the maximum load provided in the

TRUCK WEIGHTS

	Rt. Rear	Per Inch	Lf. Rear	Per Inch	Rt. Front	Per Inch	Lf. Front	Per Inch	Total Vehicle Weight
1.	7000	823.50	5800	682.35	2700	600	2700	600	18,200
2.	2200	880	2200	880	250	...	250	...	4,900
3.	4200	763.63	4300	781.8	1000	363.63	1600	581.8	11,100
4.	7200	1440	7200	1440	1600	533	1600	533	17,600
5.	5600	1120	4800	960	2000	666.6	2000	666.6	14,400
6.	7400	1345.4	5500	1000	1200	400	1200	400	15,300
7.	6000	1091	7000	1272.7	3400	850	2600	650	19,000
8.	5000	909.1	5400	981.8	1900	633.3	1800	600	14,100
9.	8400	933.3	8600	956	3000	600	3600	720	23,600
10.	7000	1000	6000	857.14	4000	888.9	2000	444.5	19,000
11.	8350	982.4	8455	994.7	2600	577.8	2600	577.8	22,005
12.	5000	833.4	5000	833.4	2400	600	2400	600	14,800
13.	3450	575	3450	575	2300	575	2300	575	11,500
14.	2900	...	3000	...	1800	...	1800	...	9,500
15.	7300	858.8	7300	858.8	2800	622.2	2800	622.2	20,200

statutes. The Departments' recommendation for gross load is 22,000 lbs. and it will be noted that this gross load has been exceeded only in a few cases, but the table indicates a serious disregard of the proper width of tires for carrying the load placed on each of these trucks.

SURVEY STARTED FOR NEW ROAD AT GYPSUM, COLORADO

Survey of a new road between Dotsero and Gypsum, Colorado has been started by highway forces under W. A. Whitney, resident engineer.

The proposed project will be six miles in length and will eliminate the worst stretch of road between Tennessee Pass and Grand Junction. During the summer months this piece of road which is a link in the Pike's Peak Ocean-to-Ocean Highway is particularly hard on travel.

The survey will start at the end of the improved road through Glenwood Canon and extend to the bridge over the Colorado River to Dotsero. The improvement planned consists of gravel surfacing, which will be taken from the river bed. The old road crosses a lava bed at one point and the gypsum soil under traffic grinds up like flour, making it exceedingly difficult for motor travel. Work on the project will be started as soon as possible. It is proposed as a Federal Aid project in which the government will share a part of the cost.

FIFTY MILLIONS FOR HIGHWAYS SPENT IN CANADA DURING 1922

A year ago the "Contract Record" predicted that fifty million dollars would be spent on Canadian roads during 1922, and this estimate proved very close to the mark, says the same journal in a recent issue. Of this total the journal continues approximately, one half has been spent in Ontario where the Drury government has proven entirely sympathetic to the demand for better roads. This province's complete programme calls for the completion by the end of 1923 of some 1850 miles of trunk lines, in addition to county and municipal work which is being undertaken in a generous spirit. Regarding the amounts spent in the various provinces the journal says:

Quebec

"The province of Quebec was an enthusiastic pioneer in the development of her highways and is worthily maintaining her record. During the first nine months of the present year the number of miles of improved highways built reached a total of 447. This amount added an to her previous expenditure gives a grand total for the province of 4345 miles.

"Most o fthe improved highways in the Province of Quebec are of the gravel surface type with macadam in second place. Of the total mileage already in use 2344 miles are gravel and 1828 macadam. Of the 1922 total of 471 miles, 389 are gravel, 74 macadam, 7 bituminous macadam and 7 concrete.

New Brunswick

"During the past year the Province of New Brunswickc built 200 miles of improved gravel highway and expects to build another 200 in 1923. Indeed it is the set plan of the province to continue the steady construction of improved gravel roads at this rate for years to come. In adition it is planned to construct 100 miles of bituminous macadam within the next two or thre years. Since the year 1917 the province has constructed 12 miles of bituminous macadam highway, 1000 miles of improved gravel and another 10000 miles of secondary roads to a lighter gravel standard.

Nova Scotia

"Since the present aggressive road-building program was undertaken by the Province of Nova Scotia the total road mileage constructed or under construction is approximately 40000 miles and it is the policy of the Highway Board to maintain these roads to the standard of their construction.

"During 1922 the Highway Board of this province have either wholly or partly completed 467 miles of road built to the Federal Aid Standard, i.e., a high class gravel or waterbound macadam. In addition some 1300 miles have been improved or are undergoing improvement and nearly 2000 miles built and maintained to a lower standard.

Saskatchewan

"The end of the present year will see a total of 700 miles of Provincial Highways completed in Saskatchewan in accord with the Canada Highways Act. During the present year 480 miles will have been built, in addition to taking care of the unfinished work of 1921. The total expenditure has been close to four and a half million dollars.

Other Provinces

"No reliable figures are available for the year's operations in Manitoba, Alberta or British Columbia. Up to April 1, 1922, the province of Manitoba had under way, on the basis of the Federal Government Act, a total of 765 miles. British Columbia, on the same basis, had 217 miles under construction. Since that date the province of Alberta has availed herself of this government aid so that every province of the Dominion is now building trunk roads under this standard agreemen.t'

MINNESOTA VOTERS URGED TO ENDORSE BABCOCK ROAD PLAN

How Taxpayers Can Get More Improved Highways for Same Outlays is Told in Bulletin

Minnesota can get more value for the same amounts of money provided for trunk highways or so-called Babcock roads by issuing proposed bonds, stopping waste on too costly upkeep and turning the funds into permanent road work. Maintenance savings will exceed the interest on the bonds and the use of more improved highways will represent net gain to the public.

This is the gist of the state highway bond plan as summarized by Charles M. Babcock, state highway commissioner, in a current highway bulletin. Careful, conservative figures, the commissioner said, show possible gains given above. All the bond money and federal aid and 40 per cent of the annual auto taxes going for improvements which will last 25, 50 and even 100 years, he repeated, the value of the state highway system to automobile and other users runs up rapidly. All figures are without tax increases—are based on the agreed average of $18 on automobiles.

The bond plan, official figures show, will give the public bigger results for the money used on the trunk highways—a full dollar's worth of good roads for every good roads dollar. But if the state goes on wasting funds for maintenance of gravel surfaces on heavy traffic sections, the commissioner finds, there will be one-third less improved highways for public use in the next ten years and one-tenth less for each year from 1933 to 1943.

Without bonds, the state must use an average of more than $4,000,000 each year of the next twenty for maintenance of the 7,000-mile trunk system. Bond money forthcoming to extend permanent improvements and stop excessive upkeep leaks, the maintenance cost can be kept down to $2,750,000 a year, making an annual saving of about $1,250,000.

Commissioner Babcock uses the same income figures in computing results obtainable with and without the proposed bonds. The average number of motor vehicles to be registered in Minnesota in the next twenty years is placed at 487,500. Automobiles taxed at the agreed $18 average and trucks slightly higher because of increases fforecast by the present legislature, auto tax revenues are averaged at $9,710,000 annually for the 20-year period. Federal highway aid receipts are put at an average of $2,566,000 a year, against $2,840,000 allotted to Minnesota in most past years. Thus the trunk highway funds are rated at $12,350,000 annually. This is comparable to the average of $20,000,000 raised in late years for county and township roads in this state, and held less in proportion because the trunk highways carry four-fifths of the traffic.

Amounts necessary to meet all present and proposed bond interest and principal payments were set aside first, and net balances remaining available for maintenance and for new construction under both plans were used in the commissioner's tables.

Increasing maintenance demands, it is shown under the present plan, will take $3,030,000 this year and larger amounts up to 1927 after which the upkeep outlay is placed at $4,150,000 a year. Auto tax balances with federal aid, but no bond funds, would afford for new construction work less than $3,500,000 in 1923, $4,070,000 in 1924, between $5,000,000 and $6,000,000 and $6,000,000 for each of the following seven years, $6,340,000 in 1932, and more than $8,000,000 a year thereafter.

Bonds authorized and maintenance costs reduced, however, upkeep can be held to an average of $2,750,000 a year, administration expenses included, according to official figures. Then with bond interest and principal provided for, there would be left for new construction $13,890,000 in 1923, $14,620,000 in 1924, more than $5,000,000 for each of the next six years, more than $6,000,000 in 1931, $6,500,000 for each of the next five and more than $7,000,000 for each of the remaining years of the 20-year period. The bonds will give the automobile taxpayer of the present a fair share of good roads benefits which he will not get otherwise, although paying the same rate of tax as those of future years.

STANDARD HIGHWAY ADMINISTRATION RECOMMENDED

Fifteen Principles Approved by Contractors and Highway Officials

The fifteen principles of highway administration and practice which follow were adopted at a joint meeting of state highway officials and general contractors which was held in conjunction with the annual convention of the American Association of State Highway Officials in Kansas City, December 4-5.

The experience of various State Highway Departments and also of many representative construction companies, during the past four years of intensive road building, has indicated that certain modifications of usual contracting practice are conductive not only to more satisfactory relations between the departments and its contractors, but also to keener competitive bidding by responsible companies.

The road building industry has developed to such magnitude and the administrative duties devolving upon the department have so increased, that it becomes essential to eliminate unnecessary difficulties in its functioning wherever possible. One step in accomplishl ing this undoubtedly depends upon securin the services of the higher type of construction companies, and upon coordinating the business principles of public contracting as far as possible with those of contracting in the commercial world. It is with this in mind that the Committee reports on certain principles herewith presented. These principles are outlined in the following recommendations:

1. Contract Surety—That where permitted by the law the highway department permit the substitution of approved negotiable securities for bond; the value of the securities deposited, except in extremely hazardous work, to equal not more than 35 per cent of the contract amount.

2. Bidder's Bond—That proposals for highway work require that no bidder's bond will be acceptable, unless accompanied by satisfactory assurance that the surety will bond the bidder for the contract, if awarded to him.

3. Payments—That where possible, monthly payments be made not later than a definite calendar date; that final payment be made within a specified time after the contractor has fully performed hs contractual obligatons; or where final payment is necessarily delayed, that a semi-final payment be made in such amount as the department may consider safe.

4. Acceptance of Work—That portions of the road, when satisfactorily completed, be accepted and paid for in sections of reasonable length, and maintenance by contractors terminated.

5. Maintenance—That the maintenance guarantee on highways, after they have been accepted, be divorced from the construction contract.

6. Classification—That where feasible the following be provided for:

(a) Excavation to be classified.

(b) Not two kinds of work to be included in a single unit where it is practicable to separate them.

(c) Overbreak or slides to be paid for at a proper rate, where the engineer is satisfied that the work is properly handled and that the breaks or slides are not due to the contractor's negligence.

7. Adjustment of Compensation—That provision be made for an equitable adjustment of extra expense entailed by:

(a) Delays and suspension of work, due to acts or omissions of department.

(b) Unusual increase or decrease in the original unit quantities.

(c) Rejection of materials after once inspected and approved.

(d) Acts of God, and outher causes manifestly beyond the contractor's control—inthose instances where the engineer is satisfied that the contractor is not at fault.

8. Overhaul—That a reasonable free haul limit, preferably not over 500 feet, be employed and that a standard means of computing costs be adopted.

9. Retained Percentage—That 10 per cent be retained on monthly estimates.

10. Force Account—That on force account work the allowance for indirect and overhead expense be set at 10 per cent of the direct labor and upon these amounts and upon the matedial a 10 per cent profit be allowed.

11. Stock Piling—That, under conditions satisfactory to the departments, payment for material delivered be included in monthly estimates.

12. Arbitration—That limited arbitration, which will reserve final decision to the engineer in all maters pertaining to prosecution of the work, but will provide for settlement of claims for compensation, be included in construction contracts.

13. Administration.

(a) That contracts be promptly awarded and certified checks returned within a specified time where possible.

(b) That written orders be given by the Department for all important instructions and especially instructions to suspend or shut down the work, the latter to state reasons of suspending or shutting down.

(c) That unless a plan for prosecution of the work is given at the time of sending out proposals, the contractor be allowed to pursue his own plan except in emergencies and providing his prosecution of the work is satisfactory.

(d) That inspection of materials be made at the source when practicable and at least before the unloading from cars.

(e) That the departments discontinue publication of the monetary amount of estimates in advance of the letting of work.

(f) That every effort should be made to secure the highest possible type of inspectors and field engineers.

14. Day Labor Construction—That true and accurate cost accounting, showing overhead and indirect expense, be required on all construction work performed by State or county forces, an exception to be made only on miscellaneous work not properly designated as construction.

15. Legislation—That an effort be made to modify existing laws in conflict with these recommendations.

H. O. Wray, assistant chief engineer of North Dakota, has announced that the state highway commission will not seek to have work done this winter, on federal aid projects, as the experience of last winter in road work in that state was not entirely satisfactory.

Personal Mention

G. M. Shepard was recently appointed chief engineer, Department of Public Works, of the city of St. Paul, Minn.

W. G. Caldwell has resigned as county highway engineeer of Waukesha county, Wisconsin, and has opened an office at Waukesha, Wis., where he will engage in a civil engineering and surveying practice.

J. R. Vernon has resigned as assistant division engineer for the Wisconsin Highway Commission at Lancaster, Wis., to acccept a position with the Johnson Service Company, manufacturers, engineers and contractors of temperature regulations and humidity control systems.

H. A. Hutchins, formerly with the Thew Shovel Company, has become associated with the main office of the Northwest Engineering Company at 1320 Steger building, Chicago. Mr. Hutchins has been with the sales force of the Thew company since 1917 ,and was district manager of the Chicago territory.

L. L. Rush, assistant engineer of the Kansas Highway Commission, has resigned to accept a position on the engineering force of the Chicago Union Station.

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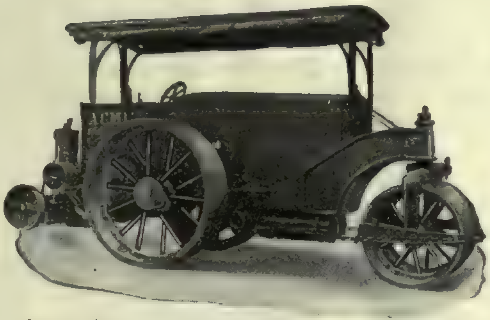

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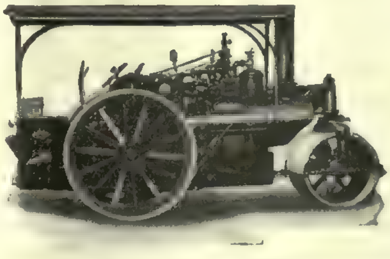

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(*Continued from Page* 41)

15. That legislation be enacted to provide against motorists running past barricades on roads under construction, and destroying unfinished work.
16. That sidewalks be provided for the use of pedestrians along the highway adjacent to built up communities.
17. That pedestrians using the highways in the open country shall walk to the left, and that operators
18. That when one piece shipments that exceed the maximum weight allowed by law are made, they shall be shipped on specially built vehicles so designed as to distribute the load in manner consistent with legal requirements, and only after obtaining permission from an authorized source.
19. That a uniform distinction be made between maintenance, betterment and reconstruction in order that comparison may be made.
20. That motor vehicle taxation or license fees should not be any greater than that required to provide the sum necessary for maintenance of the highways.
21. That overloaded trucks being operated on the highways, when apprehended, be seized and held for a period of not less than five days, stored at the owners risk and expense, and in addition the owner fined, in accordance with a penalty fixed for that offense.
22. That hauling companies, who contract for shipments by the ton, when caught overloading their vehicles, should have their license revoked, in addition to any other penalty.
23. That all operators of motor vehicles should be licensed, and that they be prohibited from operating a vehicle for more than twelve consecutive hours followed by eight hours rest.
24. That, in addition to any uniform motor vehicle law previously recommended, all applicants for drivers license or renewal of same be required to submit a physicians certificate bearing date not more than one month back of the date of application. Certificate should be accepted only from designated physicians, and should certify that the applicant is in fit mental and physical condition to operate a motor vehicle.
25. That the examination for drivers license require the applicant to be able to read and write English, and that license be granted only to citizens of the United States with provisions for tourists from other countries.
26. That the owners of all motor vehicles must carry liability insurance for each vehicle operated.
27. That all vehicles both motor and horse drawn be equipped with a clearance light visible from front and rear. This light should be of a shape other than round located on the extreme left side of the vehicle or load if over width, and howing green in front and red in rear.

Fundamental Principles

Fundamental principles are those which can be applied to the financing, design, construction, maintenance and use of the highways similarly in each and every state in the Union.

Financing Highways. It is the duty of the governing body charged with the financing of highways to provide funds for construction either by bond issue or direct tax, using funds derived from the licensing of vehicles and drivers for maintenance only.

Design and Construction of Highways. The design and construction of the highway must first provide for a graded roadway properly an dsufficiently drained and of a minimum width of thirty feet. Such a roadway should be free from sharp curves, steep grades, and all obstructions, including ditches, rocks, poles, fences, signs, drainage head walls, narrow bridges, trees, shrubbery, gas filling stations, etc.

The design and construction of the paved surface must be such as to meet the demand of regulated modern traffic. It must be of sufficient width to permit two vehicles of a size within the legal limits to pass each other at the legal rate of speed with safe clearance, and without danger of collision. In cases where such a width is not justified, it is recommended that half width pavement be constructed with one edge on the ultimate center line rather than centering a narrow pavement on the graded way. Such an arrangement will best adapt itself to future widening, and in the meantime permits of the maintenance of an adjacent earth road. Local conditions will govern in the selection of the side to be paved, but as a rule it should be on the right hand side going towards market.

It must be of a type of construction to permit carrying vehicles loaded within the specified legal limit, without injury to the pavement. The construction of the highway depends upon the faithful performance, trained knowledge and ability of those engaged to carry out the provisions of the design.

Maintenance. The maintenance, in addition to upkeep, should provide for keeping the highway open for traffic, free and clear of all obstructions at all seasons of the year. Particular reference is made here to the care that is necessary to keep the shoulders adjoining the paved surface from being worn away. Excessive work on keeping up the shoulders flush with the pavement is due to insufficient width of paved surface, and should be charged to faulty design. The minimum width of the paved surface of a highway should be classed as a fundamental principle.

Maintenance should be of the highest order, in place of permitting the road to go to pieces for lack of attention to the drainage system and the ordinary wear and tear on the surface. Maintenance does not mean the restoration of a road that was faultily constructed or a well constructed road that was injured by overloaded vehicles.

If the principles set out are followed, then the highway is ready for use. If not, then I firmly believe the highway has been abused before it has been subjected to use. Mr. A. R. Hirst's paper "Fundamentals of Highway Department Oragnization" read before the Association of State Highway Officials in December, 1922, strikes the keynote in the prevention of the abuse of the highway before it is turned over to the public.

Aside from the foregoing fundamental principles of the financing, design, construction and maintenance of the highways, I firmly believe that all the recommendations made by me to prevent the abuse of the highways, are fundamental principles for the regulation of the use of the hihgways, and that some actoin should be taken by this Association eventually to make them effective.

GOOD ROADS

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The Salvage and Maintenance of Macadam Roads

How Pennsylvania Handles the Problem

By W. A. Van DUZER

Assistant Maintenance Engineer, Pennsylvania State Highway Department

THE development of road construction and the necessity for intensive maintenance is directly attributable to the increased motorization of traffic. The problem now confronting highway engineers, and which has confronted them for the past decade, is to keep pace with this increase. As an example, motor vehicle registrations in Pennsylvania in 1912, both automobiles and trucks, totaled 58,221. In 1922 there were registered 765,000 automobiles and 66,000 trucks, or a total of 831,000 vehicles.

The funds actually expended on the maintenance of the highway system in 1912 totaled $900,000.00, while the expenditures in 1922 totaled $8,770,000.00. That is, in 1912 we had available for maintenance $15.46 for each automobile and truck registered, whereas in 1922, although there was increased travel on the roads and a very great increase in the weight and use of trucks, we had but $10.55 for each vehicle registered. This in face of the fact that our mileage has been increased in the last ten years by 1520 miles, making a total of 10,320 miles.

The finances available for road construction have of necessity limited the building of durable types of pavement and, therefore, road authorities, who have the comfort of the traveling public at heart, are applying modern methods of maintenance to some of the older types of construction, with varying degrees of success.

The Problem

The problem in Pennsylvania has not differed to any extent from that in other states, except that the stone road mileage is greater on account of the large number of toll roads that were included in the original highway system. By legislative enactment approved May 31, 1911, 8800 miles of highways in Pennsylvania were taken over for construction and maintenance at the entire cost of the state. Of this 8800 miles 521 were toll roads built by various corporations during the past century and in the main were of the macadam type of construction. The mileage of other macadam roads totaled 2100.

The majority of the toll roads and a great many of the other roads acquired in 1911 were very narrow, in some instances not over 12 ft. in width. There was a woeful lack of both sub and surface drainage. A comprehensive survey of the condition of the roads was made in 1915 and a definite policy established with regard to a program of resurfacing and reconstruction. It was felt that if the state was to have a connected system of highways a certain amount of resurfacing of the old stone roads should be taken up each year, and the demands of traffic compelled the Department to find some methods of resurfacing in addition to the waterbound macadam or penetration types. It was early shown that our finances would not permit the resurfacing of sufficient mileage with either of these types to give the required results in the desired time. It was, therefore, determind to use the waterbound and bituminous macadam upon the heavier traveled routes, while the unbound macadam, which will be fully explained later on, is used upon the secondary or less traveled roads.

Organization and Planning

In order to properly carry on the maintenance work and to provide for the increase, which would surely develop, a modern organization was established which places the responsibility for the maintenance of these roads upon fifteen District Engineers, reporting to the Maintenance Engineer, and fifty-three Superintendents, working under the direction of the District Engineers. Under the Superintendents are foremen, caretakers, laborers, etc.

We have always given a great deal of attention to the proper planning and outlining of our maintenance work, which consists chiefly of the reclamation of stone roads. Systematic and thorough surveys of local materials have been made in all parts of the state and tests taken to establish their relative values. When it is impossible to obtain local material, quotations are secured from commercial quarries and the stone is shipped in. Wherever possible mechanical means of unloading material have been adopted.

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A careful and accurate traffic census was early inaugurated, which has been of considerable assistance in determining the type of repairs. It has been our experience that the proper surfacing of a road will create a traffic out of all proportion to the seeming importance of the roadway.

At the beginning of the year a thorough study is made of the total amount of work in each district, and the necessary equipment required, such as rollers, trucks, etc., after which a schedule is made up for each job showing the length of time that the equipment will be in operation upon each specific authorization. By this method we have kept our Department equipment operating continuously, thereby reducing to a minimum the necessity of renting machinery.

Before the actual operation of waterbound macadam or bituminous macadam resurfacing is taken up, we establish by actual measurements the depth of stone in the existing roadway. In places where water breakers are found they are removed. Test pits are excavated to the bottom of the stone in the center and measurements are taken on each side for a distance of half the width of the road. These pits are dug every 25 to 50 ft., depending upon the type of the road. After this work is completed the base is widened out, and in places where sufficinet foundation is not shown additional stone is added to bring it up to the required depth. Then the road is scarified lightly and reshaped with a road machine. The base is brought to a true cross section and grade by the use of a crown board and steel pins are driven every 10 to 20 ft., depending upon the profile, and a cord stretched along the edge and to the top of the proposed ballast. Beams about 4 ft. in width and from 1 to 2 in. above the line are then built up.

Waterbound Resurfacing

Our experience has shown that more satisfactory results are obtained by the use of large stone for waterbound macadam resurfacing; that is stone varying in size from 1½ in. to 3½ in. The material is dumped upon the sub-grade and forked, thus eliminating the danger of the segregation of the sizes, which is the cause of a great deal of subsequent patching. The stone is built to a crown board and then thoroughly locked with the roller after which the screenings are applied fanwise with a shovel and rolled until the voids are thoroughly filled. The water is then applied and the road rolled until the mortar is flushed or puddled and the road is then allowed to set before surface treatment.

The maintenance of the road during the time that it is setting consists principally of sweeping, either by caretakers or lightly by mechanical brooms or horse-drawn sweepers. The sweeping is done for a dual purpose: First to remove the caked or matted screenings from the edges, which must be done in order that proper penetration of the surface treatment material may be obtained, and second to replace these screenings in the center of the highway from which they have been removed by the action of traffic, which will prevent the road from ravelling and assist in compacting it. Under especially heavy traffic it is found necessary to add screenings and during hot dry weather horse-drawn sprinklers can be used to advantage.

Previous to the first application of the bituminous material, which we believe should give the maximum penetration, the screening must be removed by sweeping so that the voids will show between the ballast to a depth of possibly ¼ in. Material must be applied in two applications with a pressure distributor, the first one to be approximately 1/3 gal. to a square yard and the second from 1/5 to 1/4 gal. as the road requires. It has been shown in some cases that 1/3 gal. applied will penetrate the road from a ¼ to 5/8 in., this penetration depending upon the kind and cementing value of the stone. The second application will heal up the spots that are not thoroughly bonded, but will not fill the voids, and leaves the ballast to take the load with the bituminous material as a binder. Although we do not ordinarily apply chips upon the first treatment, skid chipping is desirable as a safety measure on heavily traveled roads by applying from 5 to 10 lbs. of chips to the square yard.

The Treatment Necessary

In order to obtain the best results, our experience has been that three successive treatments should be made; that is the first year the treatment described above, and providing the road is subject to extremely heavy traffic, a second treatment is given the same year and the third the season following.

The second treatment should be a high viscosity bituminous material, the quantity just sufficient to properly fill the voids and this can only be determined by experience, but in most instances varies from 0.25 to 0.3 gal. per square yard.

Hard stone chips, ranging from a ¼ to 1 in. in size, dustless and free from dirt, should be used as a covering at the rate of from 20 to 30 lbs. per square yard, or approximately 1 cu. ft. of stone chips per gallon of bituminous material.

Owing to the large chips used and to assist in compressing them into the bitumen, the treatment should be rolled with either a 5 to 8 ton tandem or a 10 ton macadam roller, as soon as the chipping is completed, but, if a material that does not dry rapidly is used, we believe that equally good results can be obtained if the road is rolled from 24 to 36 hours after the bituminous application.

The third treatment may be either a high viscosity coal tar, water gas tar or asphalt, or as an alternative, a hot material. We apply from 0.15 to 0.25 of a gallon per square yard of the hot material which requires from 30 to 40 lbs of chips. This treatment must be watched carefully as the road will bleed after being thrown open to travel and, if not given proper care, will pick up under tire wagon traffic. I have known instances where a treatment of this character applied late in the fall required rechipping at the beginning of the hot weather in the spring. We have found that stone chips for covering give the best results.

The reclamation of the old base for bituminous macadam resurfacing is taken up practically in the same manner as the water-bound. After the road has been brought to a true cross section, approximately 3 in. of stone, varying in size from 1½ to 2¾ in. is spread to a depth of 3 in. This is locked by rollers and then the bituminous material is applied at the rate of 1¾ to 2 gal. to the square yard, depending upon the kind of material used.

Stone is uniformly spread, varying in size from ⅝ to 1 in. which is properly rolled and a seal coat of from ½ to ¾ gal. per square yard of bitumen is then applied and chips of approximately ½ in. are spread over the surface. The road is then rolled until it is properly bonded.

In some instances we have prepared a base, employing practically the methods of waterbound macadam construction, even to the extent of an application of bituminous surface treatment of a material giving the maximum penetration; placing on the base so prepared a hot mix of either sheet asphalt or asphaltic concrete.

The unbound macadam, which we have used with good results on secondary roads, is considerably cheaper than the waterbound construction, and for one or two seasons gives very satisfactory results. The method usually employed in the construction of unbound macadam is to scarify the old road surface, shaping it up with the road machine and rolling until a firm foundation has been obtained. Stone clear of dust, varying in size from ½ to 1½ in. is piled along the side of the road. Just ahead of the distributor, the stone is spread uniformly to a depth of approximately 2 in. Where possible traffic is kept off, or at least confined to one side. Then apply from one-third to two-third gal. per square yard of bituminous material with the proper penetration, or a larger amount where two applications are made, which is governed by the depth of the loose stone and is varied accordingly. The material is allowed to dry for from 1 to 3 days and then rolled, and, providing a larger amount is required to properly seal the road, apply one-third gal. to the square yard. Under traffic it becomes comparatively smooth and little difficulty is experienced through rutting.

We know of no type of construction that requires more uniform and continuous maintenance than stone roads. The advantage of thoroughly experienced workmen is unquestionable; care must be exercised in picking the organization and seeing that proper instructions are issued covering each phase of work.

There are two general systems in vogue in the maintenance of these roads, both of which have their advantages. First—the caretakers or patrolmen, the other the patrol or gang. The first of course, comes closer to the ideal if properly controlled. This plan arranges the road mileage in sections 3 to 5 miles in length, each section in charge of a patrolman provided with the necessary tools, materials, etc., whose duty it is to take care of the small repairs and emergency work and with authority, when necessity demands it, to hire additional men, teams, etc., upon instruction from his immediate superior. These caretakers keep the surface patched, all depressions filled, see that the side gutters and cross drains are kept open, and fill light surface depressions and sprinkle with chips tamped in place. Larger depressions are filled with large stone and then topped with patching tar and chips, the mix varying in proportion of 1 to 12 or 1 to 15, depending to some extent upon the weather. The patrolmen or caretakers file daily report cards, giving the character and extent of their work, hours engaged and nature of work performed.

The patrol gang is an organization of picked men, provided with tools, material, etc., to maintain various lengths of road mileage. It is probably more ecomical than the caretaker system, the men being well trained for each class of repair work. The difficulty experienced in this kind maintenance, however, is that it is impossible for a force of this character to give each section the required attention at the proper time, especially in emergency cases. The particular advantage of the gang system is an insurance against shortage of labor, especially on those sections of road lying sparsely in populated districts. The control can be taken care of by operation reports.

The success of stone road maintenance depends upon organization, equipment and material, a thorough knowledge of conditions and a desire from the executives to the humblest workmen to give real road service.

Developments in the Use of Local Materials

By VERNON M. PEIRCE,

District Engineer, Bureau of Public Roads

THE principal materials used in highway construction other than strictly manufactured products are broken stone, gravel and sand. Almost every type of highway which has been devised may be made to utilize one or more of these products for the greater part of the pavement. However, the material should meet certain rather definite requirements for the various types of construction. The problem, therefore, presents itself of selecting a type of construction which will utilize to the best advantage the characteristics of the particular local material which is most available. By this it is not meant that suitability of type should in any case be sacrificed in order to use local material, for in most cases it will be found that if all prejudices are cast aside some type and design of highway may be found which will utilize a considerable proportion of local material and at the same time will prove adequate to meet the local conditions of traffic, climate, etc.

Local rock, with comparatively few exceptions, will prove satisfactory for at least some portion of the highway. Frequently, however, broken stone is imported from a considerable distance either because the local product is not well suited for the type of construction selected or because no crushing and screening plant is operating in the vicinity of the work. In the former case a different type of construction equally well suited to meet the local needs may be the solution and in the latter, encouragement to contractors to open up the local deposits and if necessary to operate with portable equipment. In general, rock of a slaty or schistose structure and friable rock of a purely siliceous nature are not adaptable for highway work. Almost all other types from the hard, dense trap to the soft, coralline rock will prove serviceable when properly used.

When the waterbound or surface-treated macadam is a sufficiently high type to adopt, the gneisses, sandstones, quartzites and the very soft limestones should be used only in the foundation course, the first three because of their lack of cementing value and the limestone because of its poor wearing qualities. When such rocks are the only available local material, however, they may be used in the construction of a bituminous macadam wearing course at a cost frequently less than would be incurred by importing a rock suitable for

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waterbound construction. Thus a higher type of construction would be secured with either a saving or no additional expense. The bituminous macadam is also well adapted for utilization of rock which is not sufficiently tough or wear-resistant to be used either in bituminous concrete or Portland cement concrete pavements. Many of the sandstones fall in this class. The very soft coralline rock is unsuitable for any type of wearing course except bituminous macadam, although it makes an excellent foundation.

Many rocks unsuited for use in most wearing courses may be perfectly satisfactory for foundations of the waterbound, bituminous macadam, bituminous concrete or other types of pavements. Where so used the selection of a wearing course constructed with some other material than rock may be advisable. Thus if a suitable grade of sand is locally available a sheet asphalt wearing course may be selected or perhaps brick from some nearby plant may be used to advantage.

Gravel

Local gravel is a material which may often be used for foundation purposes with economy and satisfaction in direct competition with local rock and in certain sections of the country, it is the only available coarse aggregate product. Clayey gravels are perhaps the most unsatisfactory for use except in the waterbound or surface treated types of construction. A clayey gravel may, however, frequently be washed at a relatively low cost so as to make it suitable fo the construction of concrete foundations. The sandy gravels make excellent coarse aggregate for both Portland cement concrete and asphaltic concrete bases and if composed of hard, durable pebbles are well adapted for the coarse graded aggregate type of bituminous concrete wearing course. In fact, such a wearing course may be made to successfully utilize a wider range of local material than any other high type of construction.

Sand

Sand serves as a fine aggregate material for both hydraulic cement concrete and bituminous concrete foundations and pavements, and as a cushion course for brick and stone block pavements. There are, however, only two types of wearing course in which it constitutes the bulk of the structure. These are the sheet asphalt and fine graded aggregate asphaltic concrete pavements. Sand containing a high percentage of clay or mica are unsuited for highway use except perhaps in the treatment of subgrades or the construction of sand clay roads. A high percentage of organic matter also renders them unfit for use in Portland cement concrete, but not for hot bituminous mixtures, as the organic matter is burned out when the material passes through the drier. Fortunately, however, in localities where sand is abundant a careful survey of existing deposits will usually develop the fact that a product of almost any desired grading is obtainable. Concrete sands, which are relatively coarse and not subject to narrow grading limitations, are in general more readily obtainable than are sands for asphalt construction which require a rather fine, carefully graded product that must at the same time be practically free from particles which will pass a 200 mesh sieve. For the latter purpose, however, local material may frequently be found which can be satisfactorily used even if by itself it would be unsuitable. Thus, proper admixture of two or more local sands will often produce a desired grading which no single deposit will meet.

In a sand and gravel country when a high type of construction may be demanded and the gravel is of inferior quality for use in the wearing course, an excellent combination may often be secured by laying a gravel concrete foundation with a sheet asphalt wearing course, thus using available local material to the best possible advantage without sacrificing the quality of the finished pavement.

There are some localities where sand is the only available local road material, nothwithstanding which it may be quite practical to economically construct a high class highway. Thus a considerable portion of the country along the South Atlantic coast has very little stone for road building, although it so happens that in that territory there is an abundance of sand. These particular localities are so situated that freight rates which govern the delivery of stone are prohibitive. A solution of this problem has been secured in the following manner by the construction of a hot mix asphalt sand road in the vicinity of Wilmington, North Carolina. First a survey was made of sand deposits in the vicinity of the proposed road and a product selected which most closely approximated a sheet asphalt sand grading. A portable asphalt plant was then erected at the deposit for preparing the mix. The roadway was graded in the usual manner. Two by eight inch cypress stringers were firmly staked along the sides as forms and were left in place to protect the edge of the road under traffic and to keep the foundation confined. The subgrade was thoroughly compacted and upon it was then placed a foundation course 3 in. thick after compaction of a mixture of sand with about 7½ per cent of asphalt cement of approximately 45 penetration. Upon this base a surface or wearing course having a compacted thickness of 1½ in. was then laid, which course was composed of sand, mineral filler and asphalt cement in such proportions as to approximate a standard sheet asphalt surface mixture. In this vicinity and under favorable conditions such a road can be constructed at less than $1.25 per square yard and answers the problem of a low cost road in an undeveloped section where hard surfaced roads are necessary for the development of the country.

The Use of Marl

Deposits of marl are of frequent occurrence along the South Atlantic coast and this material when locally available makes a most excellent foundation for a hard surface wearing course. Within a few miles of the road referred to above in North Carolina a 1 in. wearing course of the sheet asphalt surface mixture has been placed on an 8 in. compacted marl base at a low cost and promises to be very satisfactory to meet all needs for years to come.

In addition to natural deposits of available local road material, there are in many sections of the country considerable quantities of waste or by-products from industries which may be successfully used in road building with a large saving in comparison with other products, either of local origin or which would have to be transported for considerable distances. Among such materials may be mentioned mine tailings, chats and slag. Mine tailings when crushed and screened to proper sizes may be used instead of broken stone in nearly all types of highways. Chats make an excellent grit products for fine graded aggregate asphaltic concrete. Slag may be successfully used in the construction of existing roads which have outlived their period to the products previously discussed, mention may also be made of shells, cinders, waste from clay product plants, straw and ashes. Such materials are particularly serviceable for building a sub-base course or improving the character of the natural sub-grade material so that a superimposed highway surface of lighter design may be constructed than would otherwise be required. All of these materials if of local origin and judiciously used, tend to lower the first cost and in many cases may also lower the cost of maintenance of the highway.

No discussion of the utilization of local material for highway construction would be complete without mention of existing roads which have outlived their period of usefulness. In most cases the bulk of the material remaining in such roads may be utilized in the construction of new roads as a part at least of the foundation for a new and frequently different type of wearing course. Indeed it is seldom necessary to remove and replace with some other product the material already on the road. Every year millions of tons of such material, which, in the strictest sense, is local, becomes available for use in highway improvements. This is true irrespective of the type of the old road provided it has not been allowed to deteriorate to too great an extent, and the further utilization of such material whenever practicable becomes a matter of primary importance not only to the conscientious engineer but to the tax paying public. It is believed that many million dollars worth of old local material from such sources should be utilized each year in the general highway program.

Blade Grader and Drag. Earth Road Maintenance in Iowa

By W. H. ROOT,

Maintenance Engineer, Iowa State Highway Commission

ON January 1, 1923, the primary roads of Iowa were classified as follows: Paving, 334.4 miles; Gravel, 1,558.0 miles; Graded and drained, 1,761.1 miles; Not built, 2,961.8 miles; Total, 6,615.3 miles. In other words, out of 6,615 miles of primary road, 4,723 miles or 71 per cent of the whole system are unsurfaced. The Iowa Highway Commission has chosen to look upon its primary road system as the backbone of a state wide transportation system. They believe that the public is entitled to a usable system of roads whether such roads have been constructed or not. As a result of this policy the maintenance forces of the state are required to maintain the whole 6,615 miles of road, 45 per cent of which has not even been built to an established grade line, and of which 71 per cent is ordinary earth road. These figures show, I believe, that the Iowa maintenance problem is an earth road problem and they explain why we have concentrated on earth road maintenance.

I think that I can state without the least reservation that the most useful and indispensable tool for the care of earth roads is the heavy blade grader. By this I mean a grader with a blade length of from 12 ft. to 16 ft., built heavy enough to do work that will require 30 to 50 drawbar horsepower. A blade grader of this sort is adapted to various kinds of work. The three main classes of blade work are:

1. Heavy blade work on roads which have never been built, that is, widening out and building to standard cross-section trails which have never really merited the name "road."
2. Finishing work on new construction.
3. Surface smoothing operations supplementary to regular patrol work.

It was in 1913, I believe, that the first 12 ft. blade machine was shipped into the state of Iowa. Now there are at least 400 of these machines in the state. In our early blade grader work we erred in not doing a thorough enough job. We paid little attention to getting the fences back to the line and clearing the right of ways. We merely shaped up the road as we found it. From 5 to 10 round trips were made and the total cost per mile was only $50 to $75. Each year, however, we have attempted to do more work and get a better road. We now require the fences and telephone poles to be moved back to the highway line before we start work. All trees, stumps and boulders are then cleared from the right of way. This work alone in some parts of the state, runs as high as $200 or $300 per mile. All heavy weed growths are also cut and raked up and burned. After the right of way has thus been cleared we are ready to start the blade work proper. The ditch line is staked out (18 ft. each side of the center line) with lath. Enough lath are used so that two laths are always visible to the grader operator.

Each mile of road is a problem in itself. An ingenious grader operator will save lots of time and money by cutting down the number of round trips necessary. High side banks, narrow fills off center, and wet ditches are only a few of the things that make a first class blade grader job difficult and expensive. We much prefer a blade grader with a back sloper attachment, that is, an attachment which may be bolted on the end of the blade so that the ditch bottom and back slope may be cut at the same time as the inside slope. A properly designed back sloper will cut the standard ditch and back slope when the main blade is cutting the standard inside slope. The back sloper should be adjustable so that the back slope can be flattened from 1½ to 1, to 2 or 2½ to 1 where extra dirt is needed.

On an average road we now make from 10 to 15 round trips with a single grader. Some counties still pull two 12 ft. graders with one tractor but I do not believe that this is economical. Where this practice prevails one grader of necessity must lie idle much of the time and the turning is more difficult. The average cost of our blade work including clearing, is about $150 per mile. However, we often have miles which run as high a $500 or $600 per mile. You would be surprised at the extensive work which is accomplished by some counties with the 12 ft. blade. We have built side hill roads in hilly counties where the material was mostly loose rock, and have had excellent results. Work of this sort when finished looks much more like permanent grading than it does like blade grader work.

No two miles of road require the same treatment, and the cost of blading, therefore, varies greatly. The following figures, however, roughly represent the cost of the average mile:

1 engineer, 25 hr. at 75 cents.........	$18.75
1 grader operator, 25 hr. at 60 cents....	15.00
125 gal. of gas at 22 cents.............	27.50

Paper presented at the annual convention of the American Road Builders Association, Chicago, Ill., Jan. 16—19, 1923.

Oil and grease	3.00
Depreciation on a $6,000 investment figuring a 3 year life of 100 working days per day—2½ days at $20 per day	50.00
Estimated repair 2½ days at $5	12.50
Interest on investment (5 per cent on $3,000) 2½ days at $1.50	3.75
Clearing right-of-way and incidentals	19.50
Total	$150.00

The second class of a bldae grader work as outlined above, is the finishing of permanent grading. By permanent grading, I mean building a road to an established grade line which is presumably a permanent one. In grading operations in Iowa most of the dirt is moved with elevating graders and dump wagons. We insist on a Mormon scraper being kept constantly at work on the dump but the best job that can be done in this way is necessarily rough. Therefore, we require every grading contractor to have a 12 ft. blade grader in his equipment. This grader is pulled by a large engine and the road finished smooth close behind the rough grading. Often the same tractor that pulls the elevator, is used evenings and at odd times to smooth up the work.

The Patrol System of Maintenance

The slogan of the National Paint Manufacturing Association "Save The Surface And You Save All" might be studied to advantage by State Maintenance Departments. The public judges a road by its surface. A road is good or bad, as it is smooth and comfortable to ride over at 35 miles an hour, or as it is rough and inconvenient to travel at that speed. The user of the road cares little for clean ditches and nicely lined shoulders, if the surface is rough. This suggests the third and most appreciated class of heavy blade work. We have the patrol system of maintenance in our state but on practically all earth roads on the primary system, we find supplementary maintenance with a heavy machine very necessary. For this work we again prefer the heavy 12 ft. blade grader. In a number of cases we have lengthened these blades to 16 or 18 ft. in order to cover the road surface in one round trip. Often we are able to pick up old graders which have become worn and loose jointed. These old machines can be bought for a song. We equip them with extension blade, put on heavy springs between the frame and the blade, to take up the play, and thus obtain an ideal maintenance machine.

The most difficult maintenance problem that we have is presented by a heavy soil road with heavy traffic, say a dense yellow clay road carrying 1,000 vehicles a day in all kinds of weather. It is obvious that before such a road has a chance to dry out so that it can be dragged, it has been hammered down until it is about as hard as a concrete pavement. However, the riding qualities are not all similar to those of a concrete pavement. It is rough and rutted and anything but a pleasure to travel over. It is also absolutely beyond the control of any light equipped patrolman. Nothing but a heavy blade will ever put such a road back in satisfactory shape for travel.

This, I believe, covers the field of the heavy blade grader. The road drag is also a widely used tool in our state but its work is not so readily classified. We have almost as many different kinds of drags and maintainers as we have operators. We have everything from 2 bladed drags weighing around 200 lb. and easily pulled by 2 horses to big heavy maintainers weighing 1 ton or more and pulled by 20 or 25 hp. tractors. I do not expect to enter into a discussion concerning the relative value of these different machines, suffice to say that they most all have their good points. In my opinion the man not the machine, is the important factor. I would rather have a live ingenious man with good road sense equipped with an old fashioned split log King drag than a "dumb-bell" with the fanciest maintainer manufactured.

How the Patrol System Operates

We divide our earth roads into patrol sections of about 10 miles each. A patrolman is placed in complete charge of each section and he is held responsible for its care. He is usually equipped with a patrol grader, a drag, a slip scraper, a plow, and a set of small tools. He also has access to other equipment such as wheel scrapers, mowers, etc. He furnishes one team all of the time and in most cases has a second team which can be procured when needed. On the heavy soils we have to use four horses even on a small patrol grader. The patrolman's first duty is to keep the surface of the road smooth. To do this he must drag or see that the dragging is done, on his entire section as soon as possible after each rain. On light soils the dragging can be started after a few hours of sunshine following a rain and the equipment may be either a light patrol grader or a drag. A patrolman on this class of soil can care for his section with not to exceed one extra dragger. On heavy soils it takes much longer for the road to dry out sufficient to drag. Here the first dragginng may be done by the patrolman but he will need 3 or 4 extra draggers. Often on this class of road the first dragging is done with heavy equipment.

In no case is one dragging enough. Lighter soils must be bladed with the patrol graders a second or third time until the surface is smooth. The first dragging on the heavy soils only partially breaks up the clods and incompletely fills the ruts. It must be immediately followed by a second or a third smoothing with heavy equipment. As stated before we prefer a 12 or 16 ft. heavy blade for this final polish.

We have also used in our dragging, a large number of the surplus war trucks which we received from the Federal Government. A separate maintainer is sometimes pulled behind the truck but we have had the best results with a maintainer built around the truck.

The Iowa earth road maintenance policy and activities might be briefly summarized as follows:

1. Realizing that we will have to depend upon earth roads on a large part of our primary system for a number of years to come, we believe that we are justified in an intensive maintenance program on these roads, in order to give the traveling public service while they wait for our construction program to eliminate the mud.
2. As a first step in this program we have graded with the heavy blade grader, practically every mile of primary road that has not been otherwise constructed.
3. For finishing grading which has been built with an elevating grader and dump wagon, the 12 ft. blade grader is a most useful tool.
4. The heavy blade is indispensable for surface smoothing especially on heavy soils.
5. Earth roads should be patroled and the patrol sections should not be over 10 miles in length.
6. All patrol and light drag work must be supplemented with heavy maintenance machines.

Current Events in the Field of Highway Engineering and Transport

ISSUES BULLETIN ON GRADING OF EARTH ROADS

In order to study the possibitities of earth roads, the Department of Civil Engineering of the University of Illinois, in cooperation with the road officials of Champaign County, has undertaken an extensive experiment on an earth road approximately twelve miles long, subject to normal traffic.

Circular No. 10 of the Engineering Experiment Station, entitled "The Grading of Earth Roads," by Wilbur M. Wilson, gives detailed information concerning the work preliminary to grading, the successive rounds of the grader, and the operation of the grader on the experimental earth road. A description of the operation of the patrol grader, which completed the construction of the road, of the equipment, and of the items included in the initial cost of the road are also given. In addition, the circular contains a summary of the cost of the experimental earth road per mile and per 12.33 miles, which is the entire length of the road.

Copies of circular No. 10 may be obtained at a price of fifteen cents by addressing the Engineering Experiment Station, Urbana, Illinois.

INDIANA TO START EXTENSIVE GRADING WORK SOON

Extensive grading work will start on state roads. Nos. 31 and 32 just as soon as weather conditions permit, it has been announced by John D. Williams, director of the state highway commission.

According to highway officials one grading outfit will work east of Rockville on Road No. 31, widening the roadbed in cuts and around dangerous curves where sight distances at present are obstructed. Another outfit will widen and straighten the road between Bainbridge and Danville, and a third crew will do similar work between Spencer and Cloverdale on Road No. 32, which was started two years ago but never completed.

A. H. Hinkle, superintendent of maintenance, states that the last mentioned section of road when taken into the system was nothing more than a trail of about 9 ft. wide. It is the intention of the commission to extend the culverts and make this roadbed thirty feet wide, he says.

Mr. Williams pointed out that most of the grading work will be done with a 10-ton tractor pulling a 12-ft. blade grader, although in many places teams will have to be used, owing to the scabrous condition of the county.

Both these roads are possessed of many narrow portions and are replete with dangerous and exceedingly sharp curves. They are the scene of serious and not infrequent fatal accidents. The commission plans to eliminate, as far as possible, these death-traps, protecting the public from the most serious by means of guard rails and danger signs.

Farmers along the roads are cooperating with the commission to improve the roads and are moving their fences back in order to provide sufficient room for a 30-ft. roadbed.

GOOD ROADS PROVED PAYING INVESTMENT

Minnesota Already Collecting More from Tourists Than it Raises for All Highway Purposes

Automobile tourists left more than $30,000,000 of new money in Minnesota last year, according to conservative estimates given in a recent highway dulletin. Although Minnesota has only just began to develop its attractions for tourists, it is added, automobile travelers in the state last season spent nearly $5 for every dollar paid by motor vehicle owners here for better highways, and $4,000,000 more than the aggregate raised in the state each year for all road work.

"It must be realized that it was our improved state trunk routes or so-called Babcock highways that made it possible for these people to visit us." said a good road advocate, "and if we are to continue to attract these people to Minnesota our road building program must be continued so that our highway system will stand on a par with the interstate highways leading into the state."

Here are the Bulletin figures:

State highway traffic census takers counted a daily average of 15,568 passenger automobiles with licenses of other states, and it is estimated that they carried 50,000 visitors. Assuming that 30,000 were entertained at homes or camped out, it would mean $60,000 at $2 each a day, and that the remaining 20,000 stayed at hotels at $5 a day for lodging and meals bringing $100,000, would make a total of $160.000 a day for subsistence. Their miscellaneous expenditures at $1 a day would mean $50,000 more. The average tourist travels 150 miles a day consuming 10 gallons of 24-cent gasoline and a quart of 30-cent oil and the tourist cars took $42,033 a day of fuel and lubricant.

GEORGIA SPENDS TEN MILLION ON ROADS DURING 1922

Georgia spent approximately $10,000,000 in road improvements, bridge construction and maintenance during 1922, according to figures just given out by the State Highway Department, completing one of the largest highway programs ever carried out in one year by any state.

A total of $8,360,706 was spent in construction work, including bridges, and nearly $2,000,000 was spent in maintenance and the betterment of roads already constructed, making a grand total of fully $10,000,000.

During the year 19 miles of asphalt highways were built, with 26 miles of concrete highways, 57 miles of chert roads, 99 miles of gravel roads, and 589 miles of sand-clay roads—a grand total of 785 miles of good roads built during the year.

In addition to this, 23 bridges, mostly concrete, steel and steel and concrete, were constructed. The bridge construction was carried out on a large scale, several large bridges connecting important highways and opening large territories having been built.

In one district alone, seventeen projects were completed at a cost of $1,224,135, and in another district more than $900,000 was expended.

During the fiscal year of 1922 the Indiana State Highway Commission contracted for 110.778 miles of concrete road, and 7.067 miles of brick pavement, a report of C. Gray, chief engineer, shows.

Of this mileage contracted there was completed up to the close of the fiscal year September 30, 1922, 63.434 miles of concrete, 3.520 miles of base for the brick pavement and 0.17 miles of brick pavement. There was carried over from 1921 and was completed during this season, contracts for 17.022 miles of concrete pavement, and 34.638 miles of grading and structure work, all of which was completed during this last season.

AN INTERESTING COMPARISON OF PAVING COSTS

Frank Howe, city engineer of Sioux Falls, has compiled some interesting facts in relation to the cost of paving in that city.

Had the city of Sioux Falls in 1922 awarded 163,262 square yards of paving at the price for which similar work was let in 1920 the total cost would have been $735,495, whereas in 1922 the total cost was $430,174, a saving of $296,321, amounting to about 40 per cent.

Year.	Sq. Yd. Average price for P. C. Concrete laid.	Sq. Yd. Average price for Asphaltic Concrete laid.
1920	$3.95 Not Reinforced	$4,13
1921	3.21 Reinforced	3.35
	2.75 (Alleys) Not Reinforced.	
1922	2.22 Reinforced	2.49
	2.12 (Alleys) Reinforced.	
These costs shown for a 44 foot frntage lot.		
1920	$367.70 Not Reinforced	$417.44
1921	327.70 Reinforced	338.83
1922	226.63 Reinforced	252.08

ROAD BUILDERS OF SOUTH DAKOTA ORGANIZE ASSOCIATION

Twenty-six road and bridge builders of South Dakota met at the Cataract hotel, Sioux Falls, and organized the Highway Contractors' Association of South Dakota.

W. R. Larson was elected chairman of the board of directors. Other officers named were:

Secretary and Treasurer—A. M. Bjodstrup, Mitchell.

Directors—Herman Pickus, Aberdeen; Edward Dowd, of Clark, and F. W. Schreiber, of Watertown.

The promotion of good road building, the discussion of problems affecting road construction, and the elevation of standards among contractors are the objects sought by the new organization.

BILLBOARDS ORDERED FROM COLORADO STATE HIGHWAYS

An order has been issued by Robert H. Higgins, superintendent of maintenance, calling for the removal of billboard signs from state highways of Colorado within thirty days.

Division superintendents have been given instructions to have all signs, which have not been taken down by owners by the end of that time, removed by force. This order applies to all signs placed upon the state right-of-way.

This means the doom of all the unsightly billboards which have become an eyesore along the main highways. It was pointed out by Supt. Higgins that the state has nothing to do with he signs now located on private property, but it is hoped that the removal of the boards from the main highways will have a tendency to check the placement of boards on private property. An appeal has been made to property owners to refuse permission for the posting of the boards on private land.

BUYS TESTING EQUIPMENT

The Canada Highways Commission has imported complete equipment for conducting standard tests on cement, asphalts, tars and road oils, according to Chief Commissioner A. W. Campbell. This equipment has been installed in the laboratory for testing materials, Department of Public Works, which now has complete testing equipment, in the hands of an experienced capable staff for making tests on all kinds of road materials. It is believed that much waste from inferior materials in highway construction will be avoided when full advantage has been taken of the facilities now available for ensuring first-class materials and satisfactory results, particularly on Federal aid projects.

A dozen models of different kinds of roads, showing approved designs, and modern drainage structures, have also been secured by the Canada Highway Commission, with a view to demonstrating economic methods of construction.

Full information concerning the manner in which samples should be prepared, fees, etc., may be had upon application to A. W. Campbell, Chief Commissioner, Dept. of Railways and Canals, Ottawa.

Five miles of the Pacific Highway leading northwest from the city limits of Seattle, Washington, is to be paved with concrete 27 feet wide. This pavement is to be laid in two sections, each 12½ feet wide separated by a ⅜-inch expansion joint. The cost will be $46,800 per mile.

MINNESOTA MOBILIZING TO SAVE BABCOCK ROAD PLAN

Spurred to action by danger of defeat for Minnesota's good roads legislation through public misunderstanding of the facts, advocates of better highways everywhere in the state are mobilizing their forces for a campaign that will carry to victory the program advanced by Charles M. Babcock, state highway commissioner.

The good roads friends are using Commissioner C. M. Babcock's point that the new program already is reducing road tax levies, that the bed-road-taxes have been dropping steadily and most rapidly in the last two years, and that conditions were and probably never will be better for building needed roads. They point to results to date as the strongest argument for going on and securing without tax increases the biggest immediate benefits held possible under the highway bond proposals.

The aim of the better highway advocates will be only to spread the actual facts among taxpayers over the state. Already they are showing that the bond proposals will mean larger mileages of grading and graveling and that paving will be built only where demanded by economy on the heavy-traffic sections of the big trunk highway system.

OFFICIAL PROPOSALS

HIGHWAY WORK

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock P. M., on Wednesday, February 7, 1923, for the improvement of highways in the following counties:

COLUMBIA.............(one highway: 2.70)
DUTCHESS....:........(one highway: 1.33)
ERIE...........(two highways: 6.61 & 4.84)
HAMILTON...........(one highway: 10.07)
SARATOGA.....(two highways: 0.08 & 0.11)
SCHUYLER.............(one highway: 3.47)

Also for the reconstruction of the following:

FULTON...............(one contract: 1:50)
GREENE...............(one contract: 3.88)
MONTGOMERY........(one contract: 4.00)
SARATOGA............(one contract: 4.24)

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the division engineers in whose division the roads are to be improved or reconstructed. The addresses of the division engineers and the counties in which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
Secretary.

ROAD BUILDERS' EXCHANGE

Reasonably ROAD BUILDING PLANT Priced

1 Austin, 10 ton, crane, mounted on caterpillar traction, and driven by Buffalo Gasoline engine, 40 ft. boom.
1 8½ D. D. Acme crusher, 12x16, elevator, screen, portable bin and 20 H. P. gasoline engine.
1 Haiss wagon loader, gasoline driven.
1 Erie, type "B" combination crane and shovel.
2 75 H. P. locomotive type boilers, on skids.
1 100 H. P. locomotive type boilers on skids.
1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.
1 7x10 Lidgerwood DC DD hoist and boiler.
1 7x10 Lambert DC DD skeleton hoist.
24,000 ft. Lakewood 24 in. ga. 20 lb. portable track, 15 ft. sections, with turnouts complete.
50 Batch box cars and 30 cu. ft. batch boxes.
4 6 ton, 24 in. ga. Whitcomb locomotives.
4 6 ton, 24 in. ga Cummings locomotives.
2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.
1 Foote Paver, Shop No. 1484, self-propelling, steam driven, 2-bag batch; overhauled ready for work.
1 14-E Rex Paver, caterpillar traction.
1 No. 11 Koehring Paver, wheel traction.
3 Lakewood sub-graders.
1 7 ton guy derrick, 70 ft. boom.
1 7 ton stiff leg derrick, 60 ft. boom.
5 Lakewood finishing machines, 16 ft., 18 ft. and 20 ft.
1 10 ton Buffalo-Pitts steam roller.
1 10 ton Austin gasoline road roller.
1 Derrick car, 8 wheel, M. C. B.

READING ENGINEERING COMPANY, Inc.
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GOOD ROADS

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"Metering" Highway Transportation to Public

Some Changes Needed in Our Motor Vehicles Laws and Licensed Fees System

By J. N. MACKALL

Commissioner of Roads, Baltimore, Md.

THERE could perhaps be no more unscientific and inequitable way of measuring to the users of the roads the benefits they derive from them than the present method of registration existing in most of the states. The methods are certainly diversified, but none of them seem to have taken into consideration the fundamentals necessary to proper registration, but instead, apparently have inclined toward the easiest method. It is perhaps but natural that this condition should exist, because the motor vehicle industry has grown faster than any industry of any kind ever grew in any land.

In the little State of Maryland, for instance, when the late Governor Crothers in his message to the legislature recommended the licensing of motor vehicles, and the charging of a fee therefor, he predicted that a considerable revenue would be obtained from this source, and that perhaps in time it would reach the sum of $100,000 per year. In the year 1922, just 14 years later, this "probable $100,000" had actually reached the sum in excess of $2,800,000. When it was decided to charge a fee for motor vehicle registration, it was generally thought that they would produce considerable revenue, but certainly it could not have been thought that they would in a few years reach sufficient proportions to maintain all the improved roads within the state.

Users of Roads Should Pay for Privilege

All forms of motor taxation have, as a general thing, been opposed by motorists, especially by large national associations of motorists. Fortunately, these organized users and their paid propagandists have at last come to see the light, and perhaps there are no more enthusiastic boosters for the idea of levying sufficient tax upon motor vehicles to pay the cost of maintaining improved roads than the motorists and the motorist associations. They have come to realize not only that if the roads are not maintained by funds derived from the motorists, they will not be maintained at all, but that they should be maintained by the users of the road as a matter of right. This change in feeling on the part of motorists has been very pronounced within the very last few years, and really it is in co-operation with these propagandists that the solution must be worked out, because it could not be worked out in face of their opposition. Until a few years ago, when a state highway department or a motor vehicle department recommended any changes in registration fees, if, as was invariably the case, the revision was upward, it was opposed by the motorists. Today that condition has changed and in many states the highway departments and motorist organizations will be found working hand in hand.

It can be stated now with authority that within a very few years the motor vehicle will pay the cost of maintaining the improved roads in the United States. The large national organizations, such as the American Automobile Association and the National Automobile Chamber of Commerce have about agreed that the roads, after once being built from *capital charges,* shall be thereafter maintained from *current receipts,* even when the maintenance implies extensive reconstruction and change in type. It is perhaps going too far to say that they have already agreed that these *current receipts* shall be from the *taxes on motor vehicles*, but the speaker believes it is not going too far to say, and he does say on his own responsibility, that they will be maintained from this source.

License Fees Must Be Fair

If, then, we agree that the motor vehicle users shall pay the entire cost of maintenance of the improved highways, then certainly it behooves us to see that this burden of cost, which is going to be a great burden, shall be equitably placed upon these users of the highway. Certainly, by no process of reasoning, can this be considered as applying in any state today. One state, for instance, the state which has the greatest number of automobiles and obtains the greatest revenue, charges for the registration of motor vehicles on the basis of horsepower and cost. The cost is on the basis of 40 cents per $100 of list price for the first three years, 20 cents for the fourth and fifth year, and 10 cents after the fifth year. Now, by what process of reasoning can it be said that a motor vehicle three years old causes four times as much wear and tear on the highway as a motor vehicle six years old. Obviously, this is an attempt to put the burden on those most able to pay, or perhaps better put, on the few owning expensive automobiles, as the class which does the least objecting and the least voting. Really, while this is an outstand-

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ing case, does it not represent the underlying principle which has brought about the very unscientific and inequitable method which exists today?

Has not the legislature on the one hand said that the motorist is able to pay so let him pay, and has not the organized motorist, through his professional propagandist, on the other hand, said that any attempt to make the motorist pay is class legislation, and has not the result been that one state followed the other in charging upon the basis of horsepower because it seemed the line of least resistance?

Fees Based on "Horsepower" Unscientific

Horsepower, as generally interpreted for motor vehicle registration, is the bore of the cylinder times the number of the cylinder times a constant. It was perhaps as fair a method of registration as could have been found in a simple manner when it was started 15 or 20 years ago, when all motors were designed with a fairly definite idea of having bore and stroke approximating each other. While it may, as said above, been fair, it was certainly far from scientifically correct, and it never did take into consideration any of the features which made the motor vehicles an agency for causing wear and tear upon the highway.

In the last ten years, however, motor vehicles have been designed with a smaller and smaller bore, and longer and longer stroke, so that today we have, on this basis of horsepower, one of the best known eight cylinder motor cars, weighing 4,500 lbs., capable of making 75 miles per hour, rated at 32 horsepower, and we have another well-known make of car, costing a few hundred dollars, weighing a few hundred pounds, capable of making a few miles an hour and rated at 23 horsepower. There is nothing equitable about this.

Many states other than the one the speaker has referred to charge on the basis of horsepower alone and many others charge on a combination of horsepower and weight, and one of the New England states does take into consideration the stroke as well as the bore in computing horsepower, but none of them have taken into consideration the distance traveled. They have assumed that a motor vehicle should pay the same whether it travels 3,000 miles or 30,000 miles in a year. Certainly, it cannot be argued that this is equitable. It would seem, then, that the early motor vehicle registration fees were worked out on an unscientific basis. They have continued until this time, on approximately, this same basis, along the line of least resistance, because there has been no co-operation between the legislator and the motor vehicle owner.

A New Viewpoint Needed

The lack of cooperation must be laid to the motor manufacturer, motor user and highway official, because each of these thought his product an end and not a means to an end. The motor manufacturer thought when he made a vehicle that he has accomplished something, the purchaser of the vehicle was very certain that he owned something of value, and most assuredly the highway official was very positive that in the construction of a road, he had done a great deal, but how mistaken are all of them! They each are a factor in motor transportation and the factors are of no value in themselves, and they only became valuable when correlated. The speaker believes that he can safely say that now all these classes realize that motor transportation is an *end* and that the factors are only *means to an end*, and that all are going to cooperate to make motor vehicles not only contribute sufficient funds for road maintenance, but make the contributions on an equitable and scientifically correct basis.

Certainly, we cannot consider longer the registration of motor vehicles on a sentimental basis. When great states like New York and Pennsylvania have collected more than $12,000,000 for the year just past, and when states like California, Illinois and Ohio collect more than $8,000,000 during 1922, and when the little State of Rhode Island collects more than $1,000,000 per year for motor vehicle registration, it cannot be said that it is a sentimental issue. It is a big business question which must be settled on this

Metering the Highway Transportation Service

If the highway departments are going to say, and they generally are saying that registration of motor vehicles is going to pay the cost of maintaining the improved roads in every state, then it is incumbent upon them to say, and to see, that legislation is enacted which will make this burden fair and just to all. This cannot be done unless it takes into consideration the service which the users of the road derive from the road, regardless of the kind of vehicles they use and regardless of the distance which the vehicle travels. If the railroads meter the service which they render to the public and charge a fee for it, depending upon the mileage traveled, and if the telephone company renders a specific service for a specific fee, varying with the quantity of service, and if the gas company, the electric light company and the utilities generally put in your house a meter which will measure the service which they render to you and bill you accordingly, then shall not the highway departments meter to the traveler the service which they have received from the roads and bill them accordingly. Certainly, this should be done if it can be done scientifically, economically and satisfactorily.

If, too, a motor vehicle is to have metered to it the service which the road renders, should it not meter that service to that vehicle regardless of where it travels. The word "reciprocity" has been used in motor vehicle legislation, but more particularly in propaganda concerning motor vehicle registration in a sense never contemplated by the definition of the word "reciprocity." Along the lines of other sentimentality in connection with motor vehicle registration, the thought has been promulgated and cognizance taken of it in motor vehicle legislation that when a vehicle has conformed to the laws of the state in which it is owned, then it shall travel in any other state as it pleases with no further restrictions so far as registration is concerned. Sentimentally this may be true; as a logical ultimate conclusion in any scheme of motor vehicle taxation to pay the cost of road maintenance, it is thoroughly illogical and should not prevail. We have today, as a result of this, all sorts and conditions of "reciprocity," none of them meaning anything, so that when revision is made in the registration of motor vehicles, this most unsatisfactory conglomeration of reciprocity laws should be taken into consideration.

How Metering Can Be Accomplished

The metering to a vehicle the service which the road renders to it, regardless of whether it is at home or abroad, can be done in a perfectly simple manner by levying a tax upon the fuel consumed in the propelling of motor vehicles upon the public highway, or in other words, a tax on gasoline. The tax on motor fuel will not meter to the travelers with exact accuracy the service which they receive from the roads, but it will meter this service almost exactly accurately and certainly infinitely more accurately than it has ever been attempted to meter this service to them before. It takes into consideration the weight of the vehicle, the speed of the vehicle, and the distance traveled—the elements which cause wear and tear, but it does not take into consideration the cost of the vehicle, or the value of the vehicle, or some theoretical horsepower rating, because these are elements which do not cause wear and tear, and have no bearing upon the service which the roads render, but instead, is purely an attempt at class legislation, which should be discontinued as a general proposition, and certainly it should be in any scheme which is to accurately measure the amount of wear and tear which any vehicle causes to the highway.

Why a Gasoline Tax Is Fair

Take the familiar "flivver," which some owners claim will make 20 miles on a gallon of gasoline, and take the Pierce Arrow, which some owners claim will make three miles on a gallon of gasoline—and there are, of course, liars who own "flivvers," as well as liars who own Pierce Arrows—both will pay a tax for the use of the road in the direct proportion to the motor fuel which they consume, which it will be found to be in almost direct proportion to the weight and speed of the car and the wear and tear it causes to the highway. Take the case of the "flivver" owned by the farmer, which stands in the garage six days a week and used on Sunday (some farmers still have "flivvers") and travels perhaps 2000 miles per year, and take another case of one owned by a public utility company, which travels every day and makes perhaps 40,000 miles per year, under any of the present plans they pay exactly the same amount as their contribution to the maintenance of roads. Under the proposed tax on motor fuel, each would pay for the exact mileage which it runs, and consequently, each would pay for the exact wear and tear which it causes to the highway.

There are today on the basis of horsepower many heavy, high-powered, high-priced automobiles actually paying less fee for the use of the road than the lowly "flivver." Some of these automobiles, capable of making enormous speeds, actually do many times as much damage to the road as the "flivver," and actually pay less to repair this wear and tear. Then, if we see that the tax on motor fuel takes into consideration the weight, the speed, and the distance traveled, we see that it takes into consideration the service which the road renders to the user, and he is automatically required to pay in advance for this service he receives.

An Added Tax for Solid Tires

So far we have taken into consideration only the pleasure vehicles, but the same facts will apply to the commercial vehicles run on pneumatic tires. The only thing, then, to be further considered is the commercial vehicle run upon solid tires. Certainly, there should be a greater charge made for the use of solid tires if solid tires cause more wear and tear to the roads than pneumatic tires. It is conceded, of course, that pneumatic tires actually do much less damage to the road than solid tires, so that the solid tire vehicle should pay a fee over and above the tax on motor fuel, but again is there not room for equalization of this? Rather than to charge, as is done in most states today, a definite fee based upon the carrying capacity of the vehicle, should this not be on gross weight? If we concede that weight is an element of wear and tear upon the road, and the speaker believes we all do agree on this, then does it make any difference whether that weight is in the chassis or in the load, provided, of course, it is equally distributed in any event. As further evidence of the need for change in registration, we find most states licensing today upon the basis of either horsepower or of carrying capacity, and relatively few basing it upon the actual weight of the truck and load combined. In addition to the regular tax on motor fuel, there should be a fixed fee charged for the registration of motor vehicles varying with and based upon the total weight of the vehicle and load combined.

If this is done, and every commercial motor vehicle required to have stamped in plain letters on the vehicle the maximum weight which it can carry, the license fee will be based upon this maximum weight, and the question of enforcement will be materially simplified.

It will be a perfectly simple matter for the enforcement officer to see that the license displayed is for the maximum carrying capacity, and by weighing the vehicle once, he can determine whether the load is greater, equal to, or less than the maximum capacity for which the license fee has been paid. This, then, takes into consideration the pleasure and the commercial vehicle equipped with solid or pneumatic tires, propelled by internal combustion engines, but it does not take into consideration the electric or steam vehicle. These will aggregate a very small percentage of the total, in most cases less than 1 per cent, and for the time being, the pleasure vehicles may be charged so much per hundred pounds of weight, including the vehicle's occupants at 150 lbs. each, at a rate about equal to the amount derived from the motor fuel tax, say, 15 cents per each 100 lb. of gross weight for each 1 cent per gal. tax on motor fuels, and the commercial vehicle a definite rate per total weight, double that of the internal combustion engine, which consumes fuel and pays a tax on it. That this method of charging registration is equitable cannot be successfully denied. The only question, then, is with reference to its collection.

How the Tax Can Be Collected

By charging and collectiong the tax on motor fuels as it comes into the state either from the refiner or from the importer, the number of dealers from which the tax is collected will be very few. In the State of Maryland, there are actually but 16 dealers under the terms of the act collecting the tax on motor fuels. These dealers are required to report and remit monthly, and the matter of auditing their books to see that they are correctly reporting is a very simple one.

The question which may appear to be troublesome is one of exemptions. It is clear that if we are going to equitably distribute the cost of road maintenance to the users of the road, we certainly should not put any of this upon the users of motor fuel for other purposes than propelling internal combustion engines used upon the public highways. The farm tractor should not be taxed, neither should the stationary engine, the motor boat, aircraft, nor should the commercial cleaning and dyeing establishments. If, however, the tax is required to be paid at its source, refunds can be made to all persons who are entitled to exemptions from the tax. This, of course, opens up a chance for deceit and for the escape in the payment of tax, but the speaker believes that inherently most people are honest, and most are also afraid to do what is wrong, and certainly, a combination of the two will prevent much evasion of the tax. In Maryland, it can be said with authority that there is practically no evasion of the tax, and the gas tax which has been in effect since June has produced $350,000, and the exemptions have been less than $3,000, or less than 1 per cent. Certainly, no one will argue that 99 per cent of the motor fuel which has been imported in the state of Maryland has gone into internal combustion engines propelled upon

(*Continued on Page 57*)

Progressive Construction of Highways

How North Carolina Is Developing the Plan

By C. M. UPHAM

State Highway Engineer, North Carolina.

IF a state had an unlimited supply of money it would be a simple problem to construct a state highway system, but practically all states are limited in the amount of money they have to spend in the construction of its road system. The function of a State Highway Commission is to provide a means of transportation for the state, and not the mere building of a few miles of hard surface roads and bridges at a few selected places throughout the state. For a state to develop as a whole, it is necessary that a connected system of highways should be available for the purpose of providing a means of transportation for the state's development.

Traffic is concerned with the roadway only to the extent of being provided with a smooth highway over which it may travel at a minimum of operation cost. The selection of the type of highway to construct is the problem of the engineer, after due consideration of all affecting elements, and should be a highway which will adequately and efficiently carry the traffic at a minimum maintenance expense.

It is absolutely essential that the road should be selected and so constructed that the money invested in the system of highways will at all times be a minimum. To best do this, means the construction of progressive type roads, in which all the standards of construction are the same, and by the use of which the lighter traffic is provided with a road suitable to its needs, and the heavier traffic with a hard surface road, which is the ultimate surface of all progressive type roads.

The solution of providing a means for traffic or the construction of a highway system in every state necessarily depends upon the local conditions in that state, and consequently, the method of solution will be different in the different states and depends on the economic, industrial, and social conditions throughout the state.

Practically every state in the Union has its cities and counties of high and intensive development, as well as its sparsely developed sections. To build immediately a system of hard surface roads throughout an entire state, when the demands for such roads are only within the highly developed sections, would be money wantonly wasted.

A Road Type to Meet Every Need

Within the highly developed sections, no doubt the construction of a hard surface pavement is the correct and only answer. In the urban and outlying districts, where the traffic is less intense, a lighter and less expensive road may adequately serve the needs of traffic. This less expensive road should be located, graded and drained upon the same standards customary with hard surface construction, so that when the country, through which the road passes, develops to the extent that traffic requires a heavy duty road, there will only be the necessity of adding the hard surface in order to adequately provide for the heavy traffic which may at some future time make demands on this highway. Still farther from the highly developed centers, and far out into the less developed country, there are still lesser traffic demands. Few vehicles and light roads generally constitute the pioneers in transportation. Quite often graded roads, with the proper drainage structures, constructed upon hard surface standards, will suitably take care of this rural traffic.

After the construction of the graded road provides a means to development, and the traffic demands become greater, a higher type surface, possibly a sand-clay, top-soil or gravel, can be added to the previously graded road, and when the locality still grows and the sections become more highly developed and the traffic demands are greater, there only remains for the road builder to surface these progressive roads with a hard surface. This will efficiently provide for the heavy traffic, which ultimately makes demands on the roads in the developed localities.

The Problem in North Carolina

North Carolina has three distinct geographical divisions. The mountain section is made up of farming and mining sections with numerous resorts so located as to take advantage of the wonderful scenery; the piedmont section or foothills, with its farms and industries highly developed; and the flat coastal plain, with its excellent farms and industries claiming great attention for their transportation needs. These three great geographical divisions are divided into one hundred counties, and many more centers of population. It is the work of the State Highway Commission to connect these centers with a highway system or a means of transportation which will adequately provide for the class of traffic which now exists and is expected in the near future. The problem of selecting the type of progressive road is somewhat reduced when it is seen that hard surface roads are immediately required to efficiently and economically care for traffic demands in connecting the developed industrial centers. This is also true in the highly developed farming sections. The remainder of the problem is to provide suitable and continuous roads to connect up the centers in a manner which will satisfactorily provide for the needs of transportation, at the same time keeping the money investment always at a minimum.

The distances are long and it is practically always the fact that the state's development and the intensity of traffic will not justify the construction of hard surface roads throughout the entire system. The answer to the problem of providing the state with a means of transportation lies in the construction of progressive type roads so constructed on high standards that they may be ultimately turned into hard surface roads by the addition of a higher type standard surface.

The Method Followed

The North Carolina method of progressive type construction is to grade the road, using the same standards for line and grade that are used in hard surface construction. Only one standard of drainage structures is used regardless of whether the road is merely graded or is to be covered with a hard surface. This construction of graded road will care for the light traffic which generally exists in all newly developed localities. This graded road is at all times maintained and when the in-

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creased traffic creates a high cost of maintenance, then it is indicated that it is time to construct the next higher type of road surface. The next step in the progressive type road is to cover the graded road with a selected soil material, such as sand-clay, topsoil or gravel. This material is generally of higher bearing value than the natural soil, and is a material which is less affected by moisture and therfore more suitable for use as a road surface. This selected surface material is maintained as a subgrade highway until such time as the maintenance cost becomes excessive and the increased traffic indicates that a hard surface roadway is necessary.

The cost of grading and the drainage structures generally constitutes about one-sixth of the ultimate cost of a hard surface road. To add a selected soil surface adds very little difference to the cost of this construction; consequently about six times as much road, with a selected soil surface, may be constructed for the same money as though the money was spent for the immediate construction of hard surface roads. This makes it possible for transportation to be benefitted to a much greater extent and the state to develop at six points rather than in one.

It will be noted that the construction of the selected soil surface is an addition to the graded road, and no previous step in the grading or construction of drainage structures has been lost or thrown away in the construction of this selected soil surface road.

In the progressive type road all steps taken in its construction include the utilization of all previous construction when transforming the road to the next higher type, and each step may be considered as a subgrade for the next higher type surface. This in itself justifies the expenditure of a sufficient amount of money to select soils of a character which may, with proper maintenance, be used as a surface material until such a time as traffic demands, or the cost of maintenance makes it necessary to construct the next higber type of hard surface. By this method of construction the graded road or the selected soil surface can truly be called a subgrade highway, and is often the economic solution for road construction over a large portion of a state system.

The ultimate step in progressive type construction is the addition of the hard surface. After the maintenance on the selected soil surface becomes excessive or when the country and traffic develops to the extent that a hard surface road is necessary, the next step is to construct the hard surface pavement directly on the selected soil surface. This method of progressive construction utilizes advantageously the selected soil surface as a stabilized subgrade for the hard surface pavement, and on account of the complete settlement, and on account of the character of the selected soil surface, the subgrade is stabilized sufficiently to aid the hard surface in carrying the loads.

Therefore it may be seen that with the construction of the progressive type road, light traffic or a small tonnage is cared for by a graded road of comparatively low cost. As the traffic demands and tonnage increases, the road is increased in strength, and the increase of the investment is justified. As the traffic and tonnage increase to the maximum, a hard surface road is constructed. The construction of roads on progressive principles means that the greatest percentage of the invested money is in permanent construction, and justifies the expenditure of bond money in any progressive type road.

North Carolina has constructed many progressive type roads. It has already completed its cycle by placing hard surfaces on roads which were previously graded and stabilized with a selected soil material, although at present it has a reasonable mileage of graded roads in the newly developed localities; it is maintaining as sub-grade highways a large mileage of selected soil roads and thus affording a means of traffic to a great portion of the state. The completion of about 400 miles of hard surface construction in 1922, many miles of which was hard surface, added to progressive type roads, demonstrates the complete and satisfactory manner in which the progressive type road is caring for the traffic in North Carolina and shows that this method of road construction is no longer in the experimental stage, but that this means of constructing a highway system is economically and practically sound and is highly recommended where the geographical, industrial, social, and economic conditions are as founded in North Carolina.

"Metering" Highway Transportation

(*Continued From Page* 55)

the public highway. If some have escaped the tax, others have not collected the rebate to which they are entitled, so that the net result has been the collection of all the tax which was due.

That the American public as a whole would rather pay tax when they do not know it than when they do know it permits perhaps of no argument. Also, the tax which is paid from day to day instead of in a lump sum on a certain day of the year is certainly the tax most easily collected and most cheerfully paid. The speaker believes that in the State of Maryland actually not 25 per cent of motorists know that they are paying a tax on motor fuel, and that there is no opposition of any kind to this tax. Those who do know the tax is being collected, also know that beginning January 1, 1924, there will be a reduction in the registration fee exactly corresponding to the amount of the gas tax, and they are perfectly willing to pay the tax until an equitable transition from registration to motor fuel tax can be effected.

The question under discussion necessarily brings in the tourist traffic. The speaker wishes that it could be left out. There is certainly no state which does not endeavor to have the foreign tourists come within its borders, and it has been said that the "tourist crop" of America is of greater value than the "corn crop," but if we are going to approach the question of changes needed in motor vehicle laws with reference to registration, then we must leave out, as has not been left out in the past, considerations of expediency and see that every user of the road, wherever he is, shall pay his proportion of the cost of maintaining the roads over which he travels. The tourist, on the basis of the tax on motor fuel, will pay his tax whether he is at home or abroad, and the money which he pays for the tax on motor fuel he will know will be used to repair the wear and tear which his vehicle has caused upon these highways.

It would seem, in conclusion, therefore, that if we can abandon as quickly as possible all of the present unscientific and inequitable methods of metering to the user the service which he receives from the road, such as registration based upon horsepower, combinations of horsepower and weight, combinations of horsepower and costs, and substitute for them the tax on motor fuel for all pneumatic tire vehicles, we will be measuring this service almost as accurately as the gas company, or the water company, or the electric light company measures the service which they render to their users. If in addition to the tax on motor vehicle fuel, we will place an additional charge against the users of solid tire vehicles, based upon the combined weight and carrying capacity of the vehicle, we will

(*Continued on Page* 60)

Current Events in the Field of Highway Engineering and Transport

Colorado to Spend Over Nine Million for Roads

Total of $4,500,000 Carried Over From 1922 in State and Federal Aid Projects —Budget Makes $1,600,000 Available for Maintenance

Funds made available for construction and maintenance of roads in Colorado during 1923 equal the sum of $9,236,350. The annual budget covering this amount for road purposes was recently approved by Governor O. H. Shoup.

Of the total amount included in the budget, $4,500,000 is carried over from the budget of 1922. This sum is represented by uncompleted contracts and work planned last year but not yet placed under contract.

The sum to be spent in 1923 on Federal Aid Projects this year will be $5,272,700. One-half of this sum comes from the government. There is made available for State Aid Projects a total of $1,494,896.

A close analysis of the budget shows that the sum apportioned to State Aid Projects represents within a few dollars the total receipts of the Highway Department from the one mill levy tax.

The number of Federal Aid Projects carried over from 1922 is thirty-three, seventeen of which remain to be contracted. In addition to these the department carries over 48 state projects. An appropriation of $328,400 is made for the latter projects.

The greater portion of the money made available for state projects will be expended in counties not included on the Federal Aid "interstate system" of roads in Colorado. It is from the construction of state projects, which otherwise would be impossible, that these counties derive an indirect benefit from the $6,000,000 bond issue authorized by the voters at the last November election.

In making up the budget the Highway Engineer and the members of the State Highway Advisory Board gave particular attention to maintenance. The sum of $825,000 is made available for this purpose. A like sum is guaranteed by the counties, making a total of $1,650.000 to be expended for maintenance purposes in 1923. Plans of the department call for the maintenance of 8,325 miles of roads throughout the state. Of this mileage, 5,292 miles will be under patrol system.

During the past year there has been an insistent demand all over the state for the installation of guide signs along the highways. In order to provide adequate marking of the main state roads, the Advisory Board recommended an appropriation of $70,000 to be used in providing markers and taking a traffic census.

Statistics gathered from the taking of the traffic census will be used in determining the type of roads to be constructed in Colorado during the next few years.

Analysis of the budget also reveals that the one mill tax now levied against property is the foundation of the present highway finances. The total amount derived from this source is $1,500,000. One-half of the levy is authorized by constitutional amendment and the other half by legislative enactment.

CALIFORNIA PAVING 18 MILES OF LINCOLN WAY IN SIERRA NEVADAS

The Lincoln Highway, northern California's most important trans-state road, has long been paved from San Francisco Bay to Sacramento, a distance of 122 miles, and from that point where the two routes from Reno north and south of Lake Tahoe come together, as far as Auburn (35 miles) on the north route and as far as Placerville (50 miles) on the south route. Thus the state has had for several years a total of 207 miles of paving on the Lincoln Highway.

This year the state has undertaken to add an additional paved link to the route north of Lake Tahoe and has had under construction all season the 18 miles between Auburn and Colfax. The grading was completed this year and some paving laid, but the route will be under construction most of 1923 also, a fair dirt detour but a few miles longer being provided between Colfax and Auburn for that travel using the northern route.

The cost of this new concrete paving, which when completed will leave but 80 miles of gravel road between Oakland and Reno, is estimated to be $635,000.

The unpaved section of the south route between Sacramento and Carson City, which runs along the south and east shore of Lake Tahoe, amounts to 60 miles in the State of California and the State Highway Department plans to pave a considerable stretch of this section of the Lincoln Way in its 1923 program. The existing road is in the main excellent gravel.

PENNSYLVANIA HIGHWAY COMMISSION WARNS AGAINST STOLEN CARS

State Highway Commissioner Paul D. Wright today warned Pennsylvanians against purchasing used motor vehicles without first making absolutely certain the machine has not been stolen.

During the last few days a "nest" of stolen machines has been discovered in Allentown, Scranton and other points in northeast Pennsylvania. Instances are reported from other sections of Pennsylvania in which unscrupulous dealers, have been selling stolen cars to unsuspecting purchasers. Not until they attempted to register these cars did the purchasers learn they were stolen.

The Automobile Division of the State Highway department has also discovered "gyps" in other states recently have been sending stolen cars into Pennsylvania. The Division has been informed that one Sam Leffitz of Bridgeport, Conn. has been held in $15,000 bail as result of investigations of Federal and Connecticut authorities. The "gyps" have been resorting to numerous subterfuges to delude purchasers. The figure "3" in the engine of manufacturer's number is changed into an "8." The figure "8" is made a "3." Having secured lists of Pennsylvania car owners, the "gyps" in devious way duplicate car numbers on stolen machines, send them into Pennsylvania and, apparently to the purchaser, make legitimate sales. In the last few days 14 of these machines were discovered in Scranton and Allentown alone. Numerous registrations of cars are held up by the Automobile Division because stolen-car records tell the machines were not the property of the vendors.

AMERICAN SOCIETY FOR TESTING MATERIALS ISSUES ANNUAL PROCEEDINGS

The American Society for Testing Materials has just published Vol. 22 (1922) of its annual proceedings. The volume is issued in two parts: Part 1 containing the annual reports of 34 of the standing committees of the society, together with the discussion thereon at the annual meeting, and 84 tentative standards which have either been revised or are published for the first time. And Part 2 contains 36 technical papers with the discussion, the annual address of the president and the annual report of the Executive Committee.

The technical papers contain valuable information on results of investigations by experts in the field of engineering materials and the reports of the committees cover Ferrous and Non-Ferrous Metals, Cement, Ceramics, Concrete, Gypsum, Lime, Preservative Coatings, Petroleum Products, Road Materials, Coal and Coke, Waterproofing Materials, Electrical Insulating Materials, Shipping Containers, Rubber Products, Methods of Testing, and Nonemclature and Definitions.

Copies of the proceedings are available at the following prices: $6.00 in paper, $6.50 in cloth and $8.00 in half-leather binding.

The Portland Cement Association announces the opening of a new district office, effective February 1, in the Hibernia Bank Building, New Orleans. This increases the list of association district offices to twenty-five. Association work in Louisiana and Mississippi will be directed from this office.

The district engineer in charge of the New Orleans office is John E. Tate, heretofore associated with our Atlanta office as field engineer in North Carolina. Prior to joining the association staff, Mr. Tate was for two years resident engineer with the state roads commission of Maryland, and for three years assistant engineer Delaware State Highway Department.

Significant of the rapid development of the Lincoln Highway in Iowa is the establishment of daily omnibus service between Boon and Carroll through Jefferson Counties in Iowa.

WASHINGTON, D. C., ADOPTS STANDARD HIGHWAY MARKERS

Tourists motoring to Washington, D. C., will find no difficulty in following the main arteries of traffic in the national capital as a result of color band markings for the main routes, worked out by the American Automobile Association and adopted by the District of Columbia commissioners. Funds for painting these color bands on the lamp posts along the routes through the city have been appropriated and the work of outlining the main arteries of travel has started.

The color band scheme, which has already been adopted in the New England states, New York and Pennsylvania through the co-operation of State and A. A. A. officials is declared by experts to be the simplest practical plan of routing a traveller through a strange city and as many other states are planning to install this system it is not unlikely that the time is close at hand when a motorist can follow a given color line from coast to coast.

As an aid to the street markings, the American Automobile Association has erected suitable signs at the main entrances to Washington explaining the proper color to follow to reach a given destination. Streets and highways running north and south will have a blue strip on the lamp posts or telephone poles. East and west thorofares will be marked with a red stripe. Avenues running diagonally will bear a yellow stripe. In each case the top of the band will be exactly 6 ft. from the ground and the width will vary from 16 in. for a single color to 24 in. where the triple combination is used. A 2 in. band of white at top and bottom will accentuate the colors.

The system of marking will start from zero milestone, a permanent monument located directly south of the White House.

These color bands are designed to aid the through traveller in avoiding the congested traffic of the down town section while at the same time leading the visitor close enough to the heart of the city to make the finding of any desired location comparatively easy.

PIERCE-ARROW PLANS BIG TRUCK PROGRAM FOR 1923

In keeping with the unmistakable indications that 1923 will be the greatest year for the motor truck, President Myron E. Forbes of The Pierce-Arrow Motor Car Company announces that a production schedule has been adopted for the year which calls for a doubled output of Pierce-Arrow trucks during 1923.

"This is going to be the year that the American business man will give very serious study to the motor truck question and select his automotive units on a basis of operating cost," declares Mr. Forbes. "It isn't a question any longer of the practicability of the motor truck, for that has been conclusively demonstrated in all lines of business and under every variety of operating condition. The question today is one of economical truck operation with the aim of maintaining constant service at the lowest upkeep cost.

"The trend to buy trucks on an operating cost rather than on first cost is increasing throughout the entire truck industry. This tendency, so far as Pierce-Arrow is concerned, has been indisputable. The signs of the times were indicated last year, when our truck business made a 35 per cent gain, with the sales curve rising steadily as the twelve-month drew to a close. The strongest confirmation, however has just been presented in the particularly heavy January bookings, which are exceptional in view of the fact that this is usually a dull month in the truck business.

"To handle the increasing demand for Pierce-Arrow trucks we have organized the most ambitious production schedule in Pierce-Arrow history. This schedule calls for the doubling of our truck business this year, which we know is not an unduly aggressive program in view of the Pierce-Arrow orders already on hand and the universal reports from Pierce-Arrow distributors of increasing truck business in their territories."

U. S. BUREAU OF PUBLIC ROADS PLANS RURAL ENGINEERING RESEARCH

In the future the rural engineering division of the U. S. Bureau of Public Roads will concentrate its work on research problems. Heretofore the division has found it difficult to relinquish its wide activities in extension work. The point now has been reached, it is believed, where the states and local agencies are sufficiently acquainted with the work to carry forward the educational part of the program.

Increased research is planned on such problems as the flow of water in drainage ditches; drainage by pumping, and the effects of alkali waters on concrete.

W. H. CONNELL APPOINTED ASSISTANT HIGHWAY COMMISSIONER OF PENNSYLVANIA

William H. Connell of Philadelphia, widely known engineering expert, has been named Assistant Highway Commissioner of the Pennsylvania State Highway Department.

"Mr. Connell has an international reputation as a highway engineer. For many years previous to 1922 he was in charge of public engineering work in New York City. From 1910 to 1912 he was deputy commissioner of public works in Bronx Borough, New York City. The latter part of 1910 he constructed the White Plains experimental roadway. From 1912 to 1917 he was chief engineer of the Bureau of Highways and Street Cleaning in the city of Philadelphia, having been appointed by Mayor Blankenburg to place the department on a sound engineering basis. For several years the late Chief Engineer of the State Highway Department, Col. W. D. Uhler, was assistant to Mr Connell. Since 1917 Mr. Connell has been engaged in private business—for two years being executive engineer for Day & Zimmerman, and from 1919 until very recently on the Executive staff of the Philadelphia Rapid Transit Company."

CEMENT OUTPUT FOR JANUARY 80 PER CENT. GREATER THAN A YEAR AGO

During January 1923, the cement mills of the country apparently operated at about 65 per cent of capacity with a total estimated production of 7,657,000 barrels of finished cement which is the largest output for that month on record and nearly 80 per cent greater than a year ago.

Shipments, which were much heavier than in any preceding January, amounted to 5,550,000 barrels, an increase of 89 per cent over January 1922. Thus stocks of finished cement in manufacturers' hands increased approximately 2,100,000 barrels and at the end of January stood at 11,285,000 barrels compared with an average of 10,725,000 barrels for the five year period 1919-1923.

Production of cement in January is restricted to some extent by reason of the fact that mills in some sections using the wet process of manufacture are unable to operate because of weather conditions. Also, numerous mills close down for repairs made necessary by the inherently rough usage to which equipment is subjected throughout the year.

The large shipments during January of this year are undoubtedly due to more general building activities as a result of an open winter in many sections than has been usual during winter months. Also partially to the fact that in some localities a greater amount is being stored for future use when heavy seasonal demands usually aggravate an already overtaxed transportation situation.

AMERICAN AUTOMOBILE ASS'N URGES AMERICAN REPRESENTATION AT INTERNATIONAL ROAD CONGRESS

Representation of the United States in the Permanent Association of International Road Congresses and attendance of delegates from this country to the fourth International Road Congress to be held in Seville, Spain, in May, are highly important to the development of highways in this country, according to officials of the American Automobile Association, which will lend every possible effort to secure passage of the bill providing for the expenditure of the necessary funds for membership and attendance of delegates.

"Every American should be interested in having the United States take part in this most important congress", declares George C. Diehl, President of the American Automobile Association. "The plan has been approved by President Harding, Secretary of State Hughes, Secretary of Agriculture Wallace, officials of the Good Roads Bureau and other prominent officials. As the annual membership fee for full representation amounts to only 15,000 francs, which at the current exchange rates represents about $600, I believe that there should be no hesitation on the part of Congress in granting the Secretary of Agriculture the necessary authority to spend this money.

"The affairs of the Permanent International Association of Road Congresses are managed by a Permanent International Commission. The organization collects the results of tests carried out on the roads or laboratory tests throughout the world of materials which are used or are suitable for road construction and maintainance. These tests are in the form of records collected by the Association or in many instances tests that have been carried out by the Association itself or under its supervision.

"The American Automobile Association has always been found in the front ranks of those fighting for good roads during its entire twenty years of existence and its united effort will be placed behind the movement to obtain membership for the United States in the Permanent Association of International Road Congresses."

INDIANA STATE HIGHWAY COMMISSION URGES PASSAGE OF GASOLINE TAX

Ever since the Ahlgren proposed gas tax bill was presented to the Indiana Legislature, certain interests have attacked the measure charging that such a tax is expensive to collect and would be burdensome to users of automotive vehicles, declares J. D. Williams, Director of the State Highway Commission.

Within the last few days however a score or more telegrams from various states collecting gasoline taxes have been received by the Indiana commission which according to the Director substantiate the contention of the equity of the Ahlgren measure that users of state roads bear the principal cost of construction and maintenance, and refute charges that such a tax is expensive and difficult to adjust. Experience of other states, says Mr. Williams, make it patent that wholesalers eventually get around to the point of paying the as tax, which in turn simplifies collection. Some telegrams point out that in numerous instances wholesalers pay this tax and use the argument to retail customers that their product is delivered tax paid, as a business stimulator. Reports to the contrary and the charge it is hard to collect; are branded as false and without foundation, telegrams to the Indiana commission assert.

In refutation of the charge of expensive collection attendant to a gasoline tax, compilation of telegrams from seventeen states collecting gas taxes, reveal the following statistics for 1922:

Oregon collected from wholesalers and importers $1,200,000. at a cost of less than $5,000.

Connecticut collected from wholesalers $734,000. (No cost of collection given.)

Kentucky collected from wholesalers $450,000. at a cost of $1,000.

Arkansas collected from retailers $208,000. at a cost practically nil.

Maryland collected from wholesalers $1,200,000. at practically no cost.

Georgia collected from wholesalers $739,188.50 at no extra cost.

Pennsylvania collected from retailers $2,389,211 at a cost of $50,000. (Maintains a special department to collect same.)

Washington collected from wholesalers $950,000 at a cost of $5,000.

New Mexico collected from distributors $130,000 at practically no additional expense.

North Carolina collected from wholesalers $780,000 at practically no cost.

Arizona collected from wholesalers $157,000 at a cost of $1,800.

Colorado collected from wholesalers $687,363.56. Cost nominal.

Montana collected from wholesalers $250,000 at negligible cost. (Requires no additional help in department).

Mississippi collected from wholesalers by practice (law designates retailer) $400,000 at cost of one extra clerk.

South Dakota collected from wholesalers $330,000 at negligible cost.

South Carolina collected from wholesalers $900,000. No cost given.

Louisana collected from producers and wholesalers $484,269. Cost and method of collection not given.

From these telegrams on file in the highway offices, it is obvious that seventeen states are collecting a gasoline tax to help build and maintain modern highways. It will also be noted that in practically every instance the cost of collection is not only negligibye, but insignificant. The most elaborate system of collection is maintained in Pennsylvania where a special department collects same. This department last year collected $2,389,211, and it cost $50,000 to do so. In the majority of states collection is made by state office forces thus there is no extra cost for collection. One state reports it is necessary to employ one additional clerk for the gas tax collection.

Anticipating the average car owner drives about 5,000 miles a year and uses from 350 to 400 gallons of gasoline, it is estimated the Ahlgren measure will cost the average car owner $5 to $8 a year. However, it is pointed out by good road advocates that this cost will be distributed over such a long period and paid in such small instalments that actual cost appears insignificant. Again the extra cost of the tax will many, many times be offset by the saving in car upkeep and on tires by the improvement in the roads this additional money will make possible.

"Metering Highway Transportation

(*Continued From Page* 57)

have reduced this to an almost scientific accuracy. Vehicles other than those propelled by internal combustion engines, equipped with either solid or pneumatic tires, which are almost a negligible percentage of the total, can be registered on the basis of total weight for both pleasure and commercial vehicles.

The only difficulty is the transition from the present method existing in the several states to motor vehicle fuel tax. This transition can be worked out with great accuracy by charging for a definite period a tax on motor vehicle fuel and registration at the existing rates, comparing the two and making a reduction in the existing rates exactly conforming to the increase brought about by motor vehicle fuel tax. The speaker believes that this can be done, he believes further that it can be done with a minimum of inconvenience and inequality to everyone, and hopes that within a very short time a uniform method of raising funds for the maintenance of roads will be a tax on motor vehicle fuel. Certainly, nothing can be fairer than this, nothing can be more equitable than this, and if we continue to raise gigantic sums for road maintenance, running into hundreds of millions of dollars every year, it behooves us to see that as quickly as possible it is raised in an equitable manner from all users of the road wherever they are. Give to the motorists by positive performace assurances that all funds so raised for road maintenance will be honestly and wisely used for the purpose, the further assurance that each man is paying for his share, no more and no less, and he will willingly pay the bill, not only because no one else will, but because it is his duty as a matter of right.

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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How to Equip and Operate Local Gravel Pits to Produce Concrete Aggregate

By H. J. KUELLING

Construction Engineer, Wisconsin Highway Commission.

THIS subject may well be approached from two angles. One from the viewpoint of the contractor, and, another, from the viewpoint of the engineer or public official. In the opinion of the writer, the use or non-use of local material is entirely one of economy; in other words, the question of which is the cheaper, local or shipped in material. It is entirely out of the question for a state, county or local community to subsidize any commercial pit or quarry. The writer frankly admits that commercial pits and quarries can produce cheaper than a temporary local plant and advises using them where the question of freight does not enter and the difference in truck hauls are not too great. However, as soon as freight on a railway enters into the argument, the handicap of ninety cents to a dollar a yard enters, a sum which alone more than covers the average production cost of the Wisconsin local pits.

Local material may consist of the production of fine aggregate alone from a sand pit, the production of coarse aggregate alone from a local quarry, or the production of both fine and coarse aggregate from a gravel pit. The nature of the subject assigned to the writer naturally confines him to the last method, although all three are in operation in his native state.

The Importance of the Subject

During the past season in that state there were constructed 355 miles of concrete road. Of these there were 187 miles on which the fine aggregates were shipped on a railway; 84 miles trucked or otherwise hauled directly from commercial plants; and 84 miles produced in local operations. In percentages these run 52.8 per cent shipped; 23.6 per cent trucked from commercial plants, and 23.6 per cent from local production.

In the matter of coarse aggregate there were 153 miles on which they were shipped on railways; 119 miles trucked from commercial plants, and 83 miles produced in local operations. In percentages these are 43.1 per cent shipped; 33.5 per cent trucked from commercial plants, and 23.4 per cent produced locally. Analyzing these on a basis of two coarse to one fine aggregate, it is readily seen that 54 per cent of the tonnage on these 355 miles of paving never saw a railway. Naturally this means cheaper concrete roads, a saving in freight, easing up on the burden of the railways, a saving in bond cost, and an easing up for the contractor in the all important matter of financing his job.

This may be a little aside from the subject but it is mentioned to show the extreme importance of a thorough study of local materials where they exist. The writer is fully aware that many, in fact, a vast majority of communities, have no such opportunities to save money, but others have and are sometimes passing by a good opportunity, as we did in more than one case.

Locating of Site

A question of equal importance with the equipping and operating is the locating and proper testing of sites. There is no doubt that much of the ill repute of local production can be traced to lack of knowledge before operations were begun. Then when the pit failed the whole question of local production was condemned. In Wisconsin we believe the matter of locating the gravel is the duty of a geologist, so all of our material parties are in charge of a geologist, just as they would be if we were to seek a deposit of lead or iron. His knowledge of geology shows him where to seek the best supplies. This has often been brought out in a startling manner in the finding of good pits where the local people insisted no material existed and where the average layman or engineer even would not suspect it. The duty of the engineer, who accompanies the geologist in locating, is to study the deposit from the physical viewpoint of whether or not it can be successfully operated.

Each party is equipped with a Ford Ambulance of the type used in the World War. They are also fully equipped with shovels, picks, cales, containers, screens, glacial and soil maps, and any other tools necessary to efficiently conduct their work. Some of the parties carry along small cooking outfits while practically all of them sleep in their cars at night. They are paid a salary and have to maintain themselves out of this. They turn in an expense account for the car, however. Each party is given a number of proposed projects to cover.

The methods of each party vary, of course, with the

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kind of material for which they are searching. Those parties whose task it is to locate concrete aggregates have to spend more time and take more care in the results than do those parties who are locating surfacing materials.

A party locating aggregate for concrete construction must first try to locate a satisfactory deposit as near as possible to the center of the project. If this is impossible they must widen out in their search, always keeping in mind, the disadvantages of long hauls and poor setups. They must also locate in each case the nearest water supply and what it is. They usually do some test pitting, especially on undeveloped deposits, to determine stripping and otherwise prove their conclusions. In general, a field test is made of the material in the nature of a silt, colorimetric and screen test. Their notes are kept on loose leaf forms provided by the Highway Commission. The deposits are spotted by section, town and range, and the owners' names obtained wherever possible. Each deposit is given a location number, these numbers starting at one and running upward consecutively in each county; there being no duplicate numbers in any one county.

Such surveys cost the state in the neighborhood of $40 or $50 per mile of project. After the surveys are made and the field information properly analyzed it is up to the materials department and the district office to see that the most promising locations are properly test pitted.

Test Pitting

The test pitting is an exceedingly important feature of the work. It must be done extensively and thoroughly. The methods involved and the extensiveness, of course, varies with the kind of material being searched for. If several miles of concrete road are to be built out of a proposed pit, it is necessary to very thoroughly test pit the site, especially if it is an undeveloped deposit. Enough holes should be dug to determine the extent and they should be dug to an adequate depth to determine the working face. We have dug holes 30 ft. and over by using box sheeting of 2 in. boards 4 ft. long dovetailed at the ends. It is an easy matter to construct a windlass operated by hand, and with a hole 4 ft. square a pretty good sized bucket can be attached for raising the material out of the opening. The samples for testing purposes should be taken at the time of digging. Our requirement for such purposes is a representative sample of 500 lbs. of pit run material from the deposit. The samples should not be taken from one hole but from several different holes. Probably the best method of handling the samples is to sack the material in cement sacks. Tags are filled out and one placed inside the sack and one attached after which they are sent to the laboratory at Madison. The man supervising the work also fills out an aggregate sheet furnished by the Commission describing the deposit, which sheet he sends direct to the materials department. Here a duplicate is made and sent to the laboratory and the original kept in the files.

Testing the Samples

From these samples tests are made, both on the fine aggregate and the coarse. Sand briquettes are made for breakage at three, seven and ten days. Coarse aggregate is tested in specimens 18 in. long, 8 in. in width, and 4.3 in. in thickness. These are always made at the same time as specimens of standard material. Both are tested at the same time in a rattler and later in tension and compression. By always running these tests with a standard, we not only can compare the material with the standard, but with any other.

The information thus obtained is placed in the hands of prospective bidders through the medium of the district offices. The cost of testing material from one deposit is estimated at about $35. If a prospective bidder is still not satisfied he may make an investigation of the material himself, and should by all means make a most careful investigation of all the physical features surrounding its use, such as water supply, topography, soil, roads, etc.

Of course no proposed gravel pit can be guaranteed to be absolutely safe. By this we mean, that even with the best kind of test pitting a few pits where opened up, disclose objectionable features which were not apparent before. These features may be enumerated as a pit running to sand, too many oversize boulders, and a pit containing heavy seams of clay. These failures, however, are few and often where there has been a failure some bit of negligence or ignorance was responsible for it.

Type of Plant Necessary

The production of concrete aggregates by means of a local plant is a problem of some magnitude. In the first place, let it be said that a plant for this purpose must be stationary. There is no such thing as an efficient portable plant for producing concrete aggregate. Another feature of the succesful plant is adequate bin capacity, for if there happens to be a temporary breakdown in the pit operating machinery and the bins are well filled, the trucks or other hauling equipment are still able to operate. Of course, the entire equipment must be efficient and efficiently operated as well. Too small a crusher or screens, not enough horsepower, poor management, and a poor pump in case of washing, are some of the objectionable factors in a plant not operating efficiently.

A well built and efficient gravel plant for producing satisfactory aggregates for concrete pavement construction should cost in the neighborhood of $10,000 to $12,000, including the item of erection. The reason for a variance between the above mentioned figures, is the difference in cost between a washing and dry screening plant, freight, erection, etc. A plant of this price has a bin capacity of about 200 yards, which ought to be sufficient. Below is a table showing the approximate cost of a stationary up-to-date gravel plant:

Crusher	$2,800
Grizzly screen	400
Blade Feeder	300
Cables, shieves, etc.	300
Hoist	1,000
Drag line bucket	450
2-60 HP. Motors	2,200
Elevator	500
Screens	400
Lumber for bins, etc.	1,000
Cost of erection	1,000
	$10,000
Cost of washing equipment	700

Another item which is really an extra is the measuring device and where batch trucks are to be used this is an absolute necessity. Such mechanical devices cost about $500.

A Typical Plant

Two plants of one contractor are identically alike, and while not absolute models of perfection are worthy of description. An arrow shaped drag line bucket handling about a cubic yard at a time pulls the material up, where it is dumped through a trap onto the blade feeder. This feeder is in the form of an endless belt which has a number of blades fastened thereon. This turns slowly and constantly dumps the material onto the grizzly screen. Thus the material is fed graduall yto the crusher while the drag line is making its return trip. The rejected gravel from the grizzly drops into a No. 4 gyratory crusher set at about 1 1-2 in. Then the material is carried up to the screens in a bucket elevator about 50 ft. high and containing approximately 140 buckets. The screens are of the revolving type, 4 ft. in diameter and in sections. The first section is 6 ft. with a 1-4 in. round opening; the second 4 ft. with a 1-4 in. round opening, and the third 6 ft. with elliptical opening 1-4 in. by 1 in. in size. For dry screening a screen of the last section type is probably the best. However, the last section of screen should have 2 in. round openings to take care of any oversize material. A chute could be built from the end of this screen back to the crusher. It has also been found very necessary at times to insert a section of 1-2 in. round screen to waste the pea gravel sizes when the gravel in the deposit runs fine. Two 60 hp. motors furnish the power for operating this plant. One takes care of the blade feeder, crusher, elevator and screens, and the other the double drum hoist operating the drag line.

The bins for this plant are 11 ft. wide, 36 ft. long, and 14 ft. deep. They are set on a concrete foundation 38 ft. long with a base of 3 ft. and tapering up to 16 in. The horizontal timbers resting on this concrete foundation and supporting the uprights are 10 in. by 12 in. The uprights themselves are 10 in. by 10 in. and 12 in. by 12 in. Seven 10 in. by 12 in. timbers are used as braces for the uprights. There are also fourteen cross braces 6 in. by 8 in. in size, seven on each side. The floor joists are 2 in. by 12 in. spaced with 6 in. centers. There is also cross bracing on the side of 3 in. by 12 in., two being used together making six pair on each side. The floor and sides of the bins are of 2 in. by 12 in. planks, the studding being the same size as the floor joists. They are double rodded, the long rods being 1 1-2 in. in diameter and the short ones 1 1-8 in. The bin supports or whales through which the rods are bolted are 6 in. by 12 in. doubled. These hold the whole bin together and there are three tiers of them, the first 1 ft. above the sill, the second 4 ft. and the third 10 ft.

Methods of Washing

A large proportion of local pits contain enough dirty material to require washing. There is also something in the proposition of expediting the work of the screens by washing, especially on damp days. A number of different types of washers are used. Probably the most common is that of old tilting box type, with which nearly every one is familiar. The valve control or discharge for the washed sand in this type is dependent of operation upon the weight of the sand contained in the settling tank. There are a few mechanical objections to a washer such

(*Continued on Page* 64)

The Development of the Custer Battlefield Hiway

By W. D. FISHER

Secretary, Custer Battlefield Hiway Association

ALTHOUGH the Custer Battlefield Hiway is less than three years old yet within this time road ruction and contracts have been let amounting to over seven million dollars. For the year just closed Montana completed 10 projects under state and federal aid most of the work being gravel. These contracts covered 114.69 miles the total cost being $991,026.32. In addition the counties along the route spent approximately another $125,000.00 making a total for 1922 of $1,116,026.32.

South Dakota leads all with fourteen state and federal aid projects completed in 1922 amounting to $1,189,586.72 with an additional county aid of $178,674.17 or a total of $1,368,260.89. Most of this work was also gravel with the exception of one or two large modern bridges the one across Jim Creek near Mitchell the Corn Palace City costing $30,236.62.

The Custer Battlefield Hiway only goes through three counties in Northern Wyoming and although this is a very thinly settled country yet the state in co-operation with the federal government has spent during the last three years $538,735.06. This does not include what the counties have spent. In addition the state highway maintains the C-B-H from the South Dakota line to the Montana line during the tourists season every fifteen miles and anyone driving over dirt roads and finding a drag on the job every fifteen miles knows what this means.

The travel over the C-B-H during the first year (1920) totaled 1,000 tourists cars. In 1921 it jumped to 6,000 cars and during the year just closed we had over 10,000 cars as taken from our four register books and we know that hundreds of cars never registered. These cars traveled on an average over the C-B-H of eight hundred fifty miles and left in the different Communities $600,000.00.

A TYPICAL VIEW ALONG THE CUSTER BATTLEFIELD HIWAY

Iowa and South Dakota were tied for first place, 133 cars from the different cities and towns being represented and many towns were represented as high as four times but the city was only counted once. Nebraska was second with 102 towns and cities represented, Montana 3rd, Wyoming 4th, Minnesota 5th and Illinois 6th.

Many improvements are being made this year along the C-B-H in practically every town and community not only on the highway but tourists camps, grounds and travelers will find on their trip to the Black Hills, Yellowstone and Glacier Parks a real highway where "courtesy greets the stranger."

(*Continued from Page* 63)

as this. First, the inertia of so great a weight makes the valve action slow, so that with uneven feeds the valve does not always close in time to prevent a "runaway." Secondly, a tank of this sort, is operated by balanced weights which to operate quickly must be set so that the valve does not close tightly when the feed of sand ceases but while the water is still coming. Sometimes, unless the valve is closed by hand, an amount of water and clay gets into the clean sand already discharged. There are also steel conical tanks on the market which are quite expensive, but more efficient as the discharge is controlled by volume rather than by weight.

A good many pit operators are using a washer of a different type. This is really a mechanical conveyor sort of settling tank. It consists of a large rectangular wash box of wood, with a discharge for clay and dirty water at one end. The floor of this box slopes upward at the other end to the top. A number of blades are fastened to an endless chain which operates over sprocket gears at either end of the box. These blades dip down into the water, and by close contact with the slanting floor carry the washed sand to the top where it is dumped over into the bins. There is a space at either end of each blade, which permits excess water to return to the tank. These blades continually agitate the dirty water in the tank and keep the dirt in suspenion until it is carrid off over the spillway. Plenty of clean water must be poured into the tank continually, and it is well to have several sprinklers playing on material as it is pulled up to be dumped into the bins. These washers are sold in two sizes, 4 ft. by 18 ft., and 3 ft. by 18 ft., respectively, and are priced at about $500, exclusive of any wash box lumber. The former size has a capacity of 40 tons of sand per hour and the latter 35 tons.

Any of these wahers, of course, are for sand only. It is sometimes and, in fact, always, just as necessary to cleanse the gravel. For this a water pipe with an end spray can be discharged into the screens. This will aid very materially in pushing the sand through the sand screen into the settling tank, and also for separating the sand from the stone, when it has a tendency to stick together in damp weather. It is also advantageous to have a section of closed screen containing angle irons bolted to the sides, which may be termed a scrubbing chamber. One of the principal requisites for a successful washing plant is plenty of clean water. Four inch pipe should be used, if possible, and a pump powerful enough and an adequate water supply to produce 250 to 300 gal. a minute, is necessary.

Construction Costs Using Local Pits

By employing local pits construction costs can be materially lowered. On one job for example, which consisted of about 8 miles of 18 ft. paving, the low bid was $1.19 per sq. yd. and the lowest bid per square yard using commercial material was $1.49, or a saving of 30 cents per sq. yd. This meant a saving of approximately $25,344 on this one job. On another road, 3.3 miles in length, the low bid being $1.29 per sq. yd. using local material. The lowest price bid per square yard using commercial material was $1.45, a saving of 16 cents per sq. yd. or a saving of $5,575.68 on the entire job. The material was trucked onto the roadbed, stockpiled and wheelbarrows used to charge the mixer. This was the second season that the contractor had operated this pit.

Another job of 4 miles was partly constructed, about 3 1-2 miles being build. The bid per square yard using local material was $1.11, whereas the lowest bid per yard using commercial material was $1.35, or a saving of 24 cents a sq. yd. This is a saving of $10,137.60 for the entire job.

One county operated two local plants. One contractor built about 40,634 sq. yds using material from one of the county pits. His price for this of $1.16 per sq. yd. was based on material at $1.00 per cu. yd. in trucks at the pit. This material, had he shipped it in would have cost him $2.18 per cu. yd. for gravel and $1.90 per cu. yd. for sand in trucks at the destination. The comparative hauls were about the same.

The other county pit kept two pavers going and about 8 miles of road were built using this material. It is rather difficult to get at the saving involved here as the contractor's bid did not include a material price, this being furnished him by the county. The county highway commissioner, however, believes that material was being produced in stock piles for about 70 cents a yard. Shipped in sand and stone would have cost $2.03 and $2.20 per yard respectively unloaded in stock piles or bins. As in the neighborhood of 26,000 cu. yds. of sand and stone were used in building the road it will be seen that considerable saving was involved (at least $30,000) by developing a local pit.

Both of these county plants used wash boxes. Each plant was equipped with a stiff leg derrick and bucket. The material as it came from the screens was loaded into a large stock pile. From here it was transferred into the big measuring hoppers and loaded into batch trucks.

It will be noted in most of the cases cited above that competitive bids were asked on local and commercial materials. This was done on practically all the early jobs to have figures for comparison. The longer in advance the preliminary information is obtained, the better, providing of course, the locations are properly protected by options so that no individual can corner the supply. The contractor or county which is to operate the pit should determine the output desired, the amount of crushing likely to be required, and the amount of water needed before designing the equipment to be installed.

In conclusion, the writer fully realizes that the use of local materials is a highly localized matter, but he also believes that where local material exists, the subject is deserving of the very best engineering and contract-talent that can be given it.

In Wisconsin it has not only been the question of money savings but it has enabled us to do work which could not otherwise be done, as it has relieved the railroads of business which they could not have handled and left equipment free for those jobs which absolutely had to be handled by rail.

Texas and New York are the states which receive the largest allotments of Federal aid for highways, which is distributed on the basis of population, area, and mileage of rural highways.

Texas leads in miles of completed Federal-aid roads with 1,733 miles. Minnesota is second with 1,416.

In mileage of Federal-aid roads under construction Texas is first with 1,408 miles, Nebraska second with 970 miles, and Iowa third with 945 miles.

Over 33,000 motor vehicles have been received by the U. S. Bureau of Public Roads and distributed to the states for use in road construction.

Current Events in the Field of Highway Engineering and Transport

FEDERAL AID ACT ASSURES ROAD BUILDING FOR THREE YEARS TO COME

When the President signed the Post Office appropriation bill authorizing $190,000,000 of government funds for road construction during the next three years—in addition to $13,000,000 for forest roads in 1923 and 1924—assurance of stability was given to the policy of federal aid. Fifty million dollars was made available for the year which began July 1st and $65,000,000 and $75,000,0000, respectively, were authorized for the two succeeding fiscal years.

Estimates have commonly been based upon an assumption of $100,000,000 yearly of federal aid. While the states, therefore, do not get all they sought, they can now plan their work in the full knowledge that a continuing policy of governmental assistance is established, in spite of the fact that the new legislation reduced the maximum participation by the government from $20,000 to $16,250 per mile for roads for the current year and to $15,000 per mile thereafter.

An important part of the new act is its provision for extending federal aid to structures involved in the elimination of railroad grade crossings. Otherwise the work will be administered as it has been since the establishment, last year, of the 7 per cent. system of primary and secondary routes.

The U. S. Bureau of Public Roads reports that plans for the interstate and intercounty systems have been received from all but eight states and that the state systems are being co-ordinated to serve the best interests of the country at large. The new appropriations come opportunely, for several states had almost reached the limit of funds available.

It is estimated that the $190,000,000 lately authorized will result in the construction of more than 25,000 miles of road which, added to the 46,000 miles estimated to result from previous appropriations, totaling $350,000,000, will produce a total of 71,000 or nearly 40 per cent of the 180,000 miles of road in the 7 per cent system of federal aid routes now outlined. Uncertainty as to the future of federal aid is removed and the states can now lay their plans for at least three years to come.

STATE HELD LIABLE FOR DAMAGES FOR CAUSING DELAY IN CONSTRUCTION

Where a state makes a contract for the resurfacing of a highway, knowing that no subbase had been made, and that this was necessary before the top and bottom course could be laid and where the contractor is given a certain time to complete his contract, but on account of the lack of a subbase is compelled to wait until the following season to complete the work, thereby suffering a loss from the rise in the cost of labor and materials. The New York Court of Claims holds, (Beskin v. State, 195 N. Y. Supp. 951) that the state was liable for the damages sustained by the contractor due to the advanced cost of labor and material, under the rule that: "Where the failure of a contractor to complete the work by the time set is due to a default of the owner, the contractor may, without notice, complete the work and recover the additional expense made necessary by the delay." Barnum v. Williams, 115 App. Div. 694, 102 N. Y. Supp. 874, affirmed 190 N. Y. 205, 6 N. E. 386; Mansfield v. New York Central & H. R. R. Co., 102 N. Y. 205, 114 N. Y. 331."

NEW JERSEY BILL WOULD OPEN ROAD SPECIFICATIONS

A bill has been introduced in the New Jersey legislature declaring for open specifications for competitive bidding in the expenditure of the $40,000,000 highway bond funds. The bill, which was introduced by Senator Mathis, declared: "It shall be the duty of the board of public body in charge of the (road) work that specifications are so drawn that the competition is in every way fair and reasonable.

INDIANA STATE HIGHWAY DEPARTMENT TO EXPLOIT ROAD BUILDING AND MAINTENANCE MACHINERY AT STATE FAIR

Road building and road maintenance machinery of every conceivable type, reclaimed was surplus equipment now doing peace time work to give Indinaa a system of superior market highways, detailed work necessary for viaducts and bridges, etc., will occupy a prominent position at the Farmers' Exposition to be held under the auspices of the State Board of Agriculture at the exposition building, State fair grounds, February 19-24, John D. Williams, highway director, announced today.

The highway department display will occupy eight booths. There will be exhibited various types of machinery for construction of rigid and secondary types, core driller, a machine by which the commission determines if specifications have been followed to the letter, a powerful motor truck as it comes from the government and one that has been remodeled or reclaimed for road work. Incidentially these machines of which the commission possesses about 1,000, come with narrow steel bodies. In the state garage they are reclaimed under direction of George N. Bartley, superintendent, at a cost of approximately $57 and equipped with larger bodies and hoist. Commercial bodies for these trucks cost three times the price it takes to equip them at the garage, Mr. Williams says.

The construction and bridge divisions will show photographic exhibits of the immense amount of detail work necessary for building roads and bridges, and the maintenance division will show how gravel and stone roads are kept in condition for all season traffic. Drags made from structural steel given the state by the government demonstrate how often former war material can be utilized for road building purposes. Standard signs for road marking to warn the traveler of sharp turns, rail and electric crossings, narrow roads, etc., will be prominent in the exhibit and are the work of maintenance division engineers.

Highway officials plan to make this exhibit so comprehensive that laymen can not help but understand and appreciate the vast amount of work necessary in caring for over 4,000 miles of state highways. It is believed, Mr. Williams says, that once the public obtains complete insight of this work, people will then understand why other states look toward Indiana as making wonderful progress in building and maintaining a state highway system even though some of these states closely following our work have vastly larger programs.

JAMES R. VALK, PROMINENT ASPHALT ENGINEER DIES

James R. Valk, district manager in the South for the Asphalt Association and for thirty years and widely known as an eminent asphalt pavement engineer, died on February 9 following an operation for appendicitis at Atlanta, Ga. Burial took place February 12 at Washington, D. C. A wife and daughter survive.

Mr. Valk, a native of South Carolina, was sixty years of age at the time of his death. Prior to his acceptance of the position with the Asphalt Association in December, 1921, he had been connected with the Alcatraz Asphalt Co., Warren Bros., Carson Petroleum Co., Standard Asphalt and Rubber Co. and the United States Asphalt Refining Co.

Mr. Valk was a man of rare personality, genial and energetic and was a man of the highest integrity. He was loved and admired by a host of friends who mourn his death. Under his management remarkable progress had been made in the promotion of asphalt pavement construction in the South and probably no man in the asphalt industry was more widely and favorably known throughout the country than was "Jim" Valk.

INSURANCE COMPANIES COOPERATE WITH HIGHWAY COMMISSION IN CAMPAIGN FOR "SAFETY FIRST" ON THE HIGHWAYS

Life insurance companies are among the big interests of the state cooperating with the state highway commission to help make market roads safe for automotive traffic, according to A. H. Hinkle, maintenance superintendent of the state highway department.

Mr. Hinkle's division in addition to maintaining all roads in the state system and keeping same open to traffic the year around—often under most trying conditions—also keeps a report of all accidents that occur on roads under highway jurisdiction.

"Since we started keeping a record of accidents I have received wonderful cooperation from life and accident insurance companies," Mr. Hinkle said. Illustrative of the close touch in which companies keep on how and when the commission by improvement reduces the danger at a given spot on a state road, he referred to the following letter from the American Central Life Insurance Company:

"The writer passed Dill Hollow, six miles east of Lafayette on Road No. 29, and was gratified to see that the highway commission has erected posts to support a railing to protect motorists at this hazardous point. Wish also to advise you that the Burlington Road from Lafayette to Rossville is in the best shape of any portion of the highways between there and Logansport."

Dill Hollow, Mr. Hinkle explained, is a very dangerous portion of Road No. 29, and has been the cause of several accidents. In 1920 a motorist was killed there, and on January 22 of this year, a Lafayette laundryman lost control of his car, went off the road at this point and was seriously injured.

According to the highway commission program all dangerous part of state roads are being eliminated as fast as possible. This has necessitated widening many miles of highways, easing curves, widening culverts and the like, but in the opinion of highway officials it is money well spent because it reduces hazards to a minimum.

Personal Mention

H. G. Horton of the Explosive Department of the du Pnot Company has been named as Western representative of the Contractors' Division of that Department with headquarters in the McCormick Building, Chicago.

John W. Gurnett, a road contractor of Watkins, N. Y., is the representative of Schuyler County in the New York State assembly. Mr. Gurnett is but twenty-six years old and claims the title of "baby of the lower house." This is Assemblyman Gurnett's first term.

George P. Coleman, was re-elected chairman of the executive committee of the American Association of State Highway Officials at its meeting in Kansas City, Mo. His term of office will be for five years. He has been a member of the executive committee ever since the organization of the association in 1912, and has been chairman of the committee during all of that time, with the exception of one year when he was president of the association.

W. J. Kelly, county engineer of Trinity County at Trinity, Texas, has been appointed county highway engineer of Montgomery County. He is stationed at Conroe.

A. E. Christhilf, former highway engineer of Baltimore, Md., has been appointed chief engineer of that city; and his successor as highway engineer is Charles F. Goob, who has been chief engineer of the electrical commission of Baltimore.

PLANS APPROVED FOR NEW PERTH AMBOY (N. J.) BRIDGE

Plans for the new Perth Amboy bridge, one of the most important highway bridges in the United States, have been approved by the U. S. Bureau of Public Roads of the United States Department of Agriculture. This bridge, to be constructed with Federal aid by the State of New Jersey at an estimated cost of approximately $3,000,000, is one of the most heavily traveled in the world, carrying the traffic from the metropolitan district of New York to the South, a large part of which is bound for Philadelphia and New Jersey coast resorts.

The structure is to replace one constructed in 1906 which is no longer adequate in width of roadway or strength to carry modern traffic. The new bridge project will consist of 1089 ft. of concrete viaduct, 1538 ft. of steel plate girders, a 360 ft. swing draw, and 5490 ft. of earth fill on approaches. The roadway will be 38 ft. wide to accommodate four lines of traffic with side-walks on each side. Construction will be commenced during the coming season.

THOSE HIGHWAY BONDS

"While the Tribune is in hearty accord with those who look to the Legislature for the strictest economy in expenditures, yet we fail to see any real economy in curtailment of the highway program proposed by Commissioner Babcock. Considerable opposition has developed to his proposed plan for two ten million dollar bond issues by which he hopes to bring to an early completion the highway program which was contemplated under Amendment No. 1. Such opposition is not based altogether on sound argument."

"As a matter of fact, the bonds cannot bring any increase in taxes, since they will be paid off under provisions of the automobile law, but they will provide the necessary funds with which to give the country districts needed roads which would otherwise be built piecemeal. 'Let us pay for our roads as we go,' says the opposition, but it may be pointed out that there is just as much sense in building a home by erecting the foundation one year, the first story the next, the superstructure next, etc., the interior finishing coming after a long lapse of years, as there is in this continual tearing up of country roads. Our traffic demands have changed since the days of the poll tax system of building roads, and we must govern ourselves accordingly. Manifestly a small section of good roads on a given stretch is of little use, as the farmer who hauls his product to market must adjust his load to conform to the bad stretch, and likewise the traveler in his touring car must judge a road by its bad features. By all means let us get our roads fixed up—and that soon."

"We approve of the Babcock plan under which Minnesota can build her roads in the same manner as the man of ordinary means builds a home—by using his credit to provide comfort for the PRESENT for himself and family. It is the right idea with respect to home building—it is the right idea with respect to road building. No one will benefit as much as will the farmer from such a program. He needs good roads NOW for his PRESENT convenience and comfort, and will be more contented and will possess more valuable holdings when a good road passes his door."

The Babcock bond plan should not be mixed up with the general program for reducing taxes all along the line—a program which meets with the hearty approval of this newspaper.—(Thief River Falls Tribune)

Kansas motor car drivers must hereafter drive on their own sideof the road or be held responsible for every accident on the highways in which they are in any way involved. This is the statement authorized by N. W. Watson, State Highway Engineer. Concrete road designs call for a longitudinal joint down the center of the road. This joint is to be bound together with reinforcing steel and is to provide a half-inch opening at the top to fill with some type of black filler. This will form a distinct center line down the road. Anyone traveling on the wrong side of the line is to be held responsible and canot escape blame for any accident in which he is concerned.

The Marion (Indiana) county board of commissioners have used their rural mail carriers as highway reporters. The rural carriers tavel a large portion of the highways in the county each day. Naturally they know intimately the condition of the roads. Blanks are supplied and these in turn are turned over to the road superintendent in each district.

The Blaw-Knox Company, Pittsburgh, has just issued its new catalogue, "Road Building Equipment." The catalogue is illustrated and contains attractive descriptions of the Blaw-Knox Company's products for the road builder. Blaw Forms for roads and streets, batcherplants, adjustable measuring batchers, truck turntables, and portable steel handy houses, on various road jobs under variable conditions. This catalogue will prove most interesting to the road builder and will be furnished to all interested on application to Mr. D. Clinton Grove, Advertising Manager.

The George Haiss Mfg. Co., Inc. 141st St. and Rider ave., New York, has recently put on the market a Haiss Truck Loading Elevator mounted on a Fordson Tractor. This machine is a new idea in Truck loaders and the chassis used is the standard Fordson Tractor equipped with cleats or rubber tired wheels. The elevator is mounted on a structure having a three point suspension and is equipped with Haiss patented feeding propellers with a capacity of 40 tons per hour. The total weight of the machine is 6,000 lb. and owing to its portability this machine makes a very suitable unit for contractors that desire to load trucks or unload hopper bottom cars at points some distance from one another. Full description of this machine may be secured on application to the company.

GOOD ROADS
Title Reg. U. S. Pat. Off.
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The Advantages of Standard Specifications for Bituminous Materials

A Discussion of the Subject as It Relates Particularly to Asphalt

By PROVOST HUBBARD

Chemical Engineer The Asphalt Association

THE advantages of standardizing specifications for any and all materials of construction, when practicable, are so evident as to require but brief comment as related to the asphalt industry. In the first place such standardization makes for uniformity in marketed products. The producer knows in advance just what products he will be called upon to supply and is able to keep on hand sufficient stock to fill orders promptly as received. This makes it possible for refinery operations to be conducted in a uniform manner thereby reducing the cost of such operations and at the same time eliminating unnecessary and expensive storage facilities. The cost of production is of course reflected in the market price of a material and in this connection standardization always works to the advantage of the consumer. Moreover, the consumer is practically assured, in advance, of the quality of the material which he will receive after placing an order and the expense of inspection may be kept at a minimum, as on standardized products a few simple check tests practically insure conformity with most of the other essential requirements. He can also obtain small quantities of materials as readily as large quantities because the producer always has a stock on hand from which to make delivery. To sum up, the principal advantages of standardization are lower costs, prompt service, convenience of inspection and assurance of uniformity.

Variety of Specifications Caused Confusion

On the other hand if the producer is faced with a great variety of specifications he must either refuse some markets, to which he should have convenient access in order to create competition, or he must be constantly changing his plant operations thereby creating opportunity for mistakes of a more or less serious nature to himself as well as the consumer. He must be equipped with expensive storage facilities if he wishes to maintain sufficient stock of each variety of product to fill orders promptly and he never knows when some apparently slight modification of an existing specification may eliminate material which he is carrying in large quantity and thus cause considerable loss. If he does not carry stock on hand it is often difficult if not impossible to fill orders promptly and many small orders must be refused as it would not be profitable for him to turn out a still of material on an order for a few barrels or even tons.

Standardization Means Stabilization

Too many engineeers and chemists play with asphalt specifications as though the various requirements were independent units which could be varied at will. As a matter of fact most of the properties covered by test requirements interlock to a considerable extent so that unless the test limits are very broad a change in one requirement affects a number of others. An apparently slight modification of one existing requirement may therefore throw the entire specification out of joint if the test limits are narrow. Theories or preferences unsupported by service or other data are often the basis of ill advised changes in existing specifications or the formulation of new and unusual requirements. Standardization of specifications with general acceptance of such standards does not prevent changes in requirements as they become advisable or necessary but does head off changes which might otherwise be made without sufficient supporting evidence. Standardization therefore means stabilization which is in the interest of both producer and consumer.

Absence of standardization frequently leads to a generally unwarranted and sometimes corrupt practice of drawing test limits so as to admit only a single trade product and eliminate other products equally as good and perhaps better adapted for the particular use to which the material is to be put. Such specifications in effect create a monopoly which almost inevitably leads to unjustifiably high cost to the ultimate consumer and may be used by the unscrupulous as a basis for offering or demanding graft. This is a danger which should be eliminated if possible.

Although other arguments might be advanced it is believed that enough has been said regarding the ad-

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vantages of standardization, if practicable, and it therefore remains only to consider the practicability of such standardization as applied to asphalts for use in highway engineering. To do this intelligently it is necessary to give some thought to the origin, method of refining and essential characteristics of asphalts as determined by tests and to take into account existing conditions in the asphalt industry which have a bearing upon the output of available products.

In the first place it is a recognized fact that all asphalt originates in petroleum, whether produced by natural agencies or at a petroleum refinery. In general asphalt may be defined as a semisolid or solid sticky product formed by the partial evaporation or distillation of certain petroleums. These petroleums originally contained the asphalt dissolved in relatively light volatile oils. Natural evaporation of these lighter oils at or below the earth's surface has produced deposits of lake asphalt while their removal by distillation in a still at a refinery produces the so-called petroleum asphalts. There is no essential difference between lake asphalt and petroleum asphalt except that the former during its process of formation, has become mixed with varying amounts of vegetable particles, clay, silt, water and gas, while petroleum asphalt is practically free from such materials.

TABLE 1—TEST REQUIREMENT OF ASPHALT SPECIFICATION

TEST	A. S. M. I.	A. S. T. M.	ASPHALT ASS'N
1. General	Homogeneous and free from water	Homogeneous and free from water	Homogeneous, free from water, not foam, at 347 deg. Fahr.
2. Flash point, deg. Fahr. not less than	350	347	347
3. Penetration at 77 deg. Fahr......	25 to 45 (a) 45 to 70 (b)	40—50 50—60 60—70	30—40 40—50 60—60
4. Ductility at 77 deg. Fahr. not less than	30 (c)	30	30
5. Per cent. loss at 325 deg. Fahr., 5 hr. not less than..............	3	2	3
6. Penetration of residue in per cent. of original penetration, not less than	50	60	50
7. Proportion of bitumen soluble in carbon tetrachloride, not less than		99	99

(a) heavy traffic, (b) light traffic, (c) increased ductility of 2 required for every 5 points penetration above 50, and allowance of decrease of 2 made for every 5 points penetration below 50.

Lake asphalt must always be refined before it is suitable for paving purposes, first by heating and agitating it to remove the volatile impurities. It is then too hard for use and must be softened to suitable consistency by combining it with a petroleum residual oil known as flux. Petroleum asphalt on the other hand is recovered at any desired consistency by merely distilling off the proper amount of oils which hold it dissolved in the crude petroleum.

The principal sources of supply for paving asphalt are Mexican petroleum, California petroleum, and two lake deposits, one occuring on the Island of Trinidad and the other, commonly known as Bermudez asphalt, occurring in Venezuela. In addition a considerable amount of asphalt is refined from a mixture of Mexican and domestic petroleum. It is possible to identify asphalts from each of these sources by means of certain tests and it is therefore possible to prepare individual descriptive specifications for products from each source. Service results have, however, demonstrated that these purely descriptive tests or test limits are not necessary as a guarantee of quality under existing refinery practice and that a comparatively few test limits, which have nothing whatever to do with origin, are sufficient for all practical purposes. This fact has for some time past been recognized by the American Society for Municipal Improvements in its specifications for asphalt for sheet asphalt pavements, and has been adopted as a basis for the Tentative Specifications of the American Society for Testing Materials. Most of our cities which have had long experience in asphalt paving work have adopted a similar policy in connection with their asphalt specifications, although some cities and states, including New Jersey, have not as yet seen fit to do so.

General elimination of origin requirements or test limits in asphalt specifications constitutes a first long step in the matter of standardization as it paves the way for the adoption of essential tests only and makes it easier to agree upon the test limits which should be used. While it is impossible, in the time allotted for this paper, to discuss in detail all of the tests and test limits found in asphalt specifications the possibilities and the progress already made in the matter of standardization may be illustrated by comparing present specifications for asphalt cement for sheet asphalt pavements of the American Society for Municipal Improvements, the American Society for Testing Materials and The Asphalt Association. A tabulation of the test requirements of these specifications is given in Table 1.

In this tabulation it will be noted that there are seven tests enumerated, six of which are common to all three specifications. In all three the limits of requirements 1, 2 and 4 are practically identical, and it is evident that the slight differences in test limits of requirements 5 and 6 might be readily harmonized. As a matter of fact if a single composite specification were prepared from all of these requirements, selecting the limits which were most restrictive it is believed that the result would be quite satisfactory for both producer and consumer. It is to be hoped that the various states, counties and cities throughout the country will get behind this effort to standardize and thus eliminate the unnecessary variations in many existing specifications.

One very important feature of the standardization of asphalt specifications has to do with the simplification or elimination of grades. For paving purposes asphalt cements are graded according to their consistency or degree of hardness as determined by the penetration test. Penetration limits are therefore an essential part of all asphalt specifications. Different grades of asphalt aer required for the different types of asphalt pavements and for any given type the most suitable grade to use will depend to some extent upon climatic and traffic conditions to which the pavement will be subjected. This fact is recognized by both producer and consumer but the latter is frequently inclined to attach too much importance to the exact penetration limits which he should specify and often adopts limits which call for a special grade when some more commonly used grade would serve his purpose equally well.

In an article appearing on page 539 of the September 8, 1922, number of *Engineering News-Record* the existing variation and multiplicity of asphalt specifications is discussed at some length with particular reference to penetration limits. The following is quoted from this article as of especial interest in this connection:

"Eliminating factors of lesser importance the keynote test for asphalt quality is that of penetration and in any effort to secure greater uniformity in specifications the first effort should be directed toward a reasonable standardization of penetration limits. Many states fix a range at 10 points for a given grade; ;some of them use an even scale, from 56 to 60, for example, while others adopt odd scales, as 55 to 65. In some recent cases an 7 point or a 9 point range is specified. In other cases very wide limits of penetration are specified, with the notation that within this range the exact penetration will be set by the engineer. Such a requirement places the producer at a great disadvantage as he does not know what limits will be set by the engineer."

As a result of practices above quoted existing specifications call for a great number of overlapping grades of asphalt some of them with unnecessarily narrow and some with unnecessarily wide penetration limits. It is believed that this condition might well be remedied by the general adoption of six or seven clearly defined grades which do not overlap and which are sufficiently comprehensive and at the same time sufficiently restrictive to insure suitability for use in the various types of asphalt pavements under different climatic and traffic conditions.

The article in the *Engineering News-Record* brought forth written discussions by a number of leading highway engineers all of whom favored simplification in grades of asphalt and this matter is now being looked into by the Division of Simplified Practice of the U. S. Department of Commerce which has offered to cooperate in effecting such simplification. It is to be hoped that in the near future both the simplification of grades and the standardization of tests requirements for paving asphalts will be rapidly advanced in the interest of producer and consumer alike.

Patrol Maintenance in Wisconsin

A Record of Five Years Experience

By J. T. DONAGHEY

Maintenance Engineer, Wisconsin Highway Commission

CONDITIONS existing in Wisconsin prior to April 1, 1912, were similar to those existing in a majority of the Middle-Western States at that time. Under the provisions of various lows, individual roads had been constructed and a very small amount of maintenance work had been done, and what had been done was entirely unsystematic. We had built to that date under our state aid and county laws approximately 3375 miles of surfaced roads and 2800 miles of unsurfaced roads, but no effective provisions were made for their maintenance. In a very few instances proper maintenance had been provided, but in a majority of cases the roads were permitted to deteriorate rapidly.

Wisconsin has 78,000 miles of all classes of highways, at the time of taking over the maintenance in the spring of 1918 .and our records show that 245 miles were concrete; 1773 miles stone macadam; 15,670 miles gravel, most of which was ordinary town work; and 60,300 miles earth. We believed that a system containing not less than 10 per cent. of the total road mileage of the state would be required to serve traffic reasonably well, and that evntually the public would demand that not less than 20 per cent. of the total road mileage be adequately maintained. However, we felt that the maintenance of a 20 per cent. system was many, many years in the future.

In discussing the future maintenance of a large state trunk highway system before the Legislature of 1917, the question arose as to whether the state should maintain the entire system with a state organization, the state paying the entire cost, or whether the actual maintenance work should be done by each county and the county be reimbursed by the state after the work was satisfactorily performed. There were many advocates for each plan, and after analyzing the two plans thoroughly the Commission decided to operate through the counties as a unit, primarily because it believed that the sentiment which would be created for the improvement of roads other than those contained in the State Trunk Highway System would eventually more than offset the possible inefficiency and other unsatisfactory features of this plan.

In April, 1917, a law was enacted creating a State Trunk Highway System to be selected by the Highway Commission and a special committee of five legislators appointed by the Governor. The law provided that on May 1, 1918, the counties must take over the maintenance of the system selected.

For convenience in handling road matters, the Commission has established nine divisions containing approximately eight counties each. A resident engineer, called Division Engineer, si in charge of each division, having the necessary assistants to properly plan and supervise the work in each division. An assistant, known as Di-

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Paper presented at the annual convention of the American Road Builders Association, Chicago, Ill., Jan. 13-19, 1923.

vision Maintenance Engineer, has charge of all maintenance, marking and signing. The latter visits each patrolman at least twice a month, reporting each visit by card to the main office. In 1922 10,940 visits were reported, giving us accurate information at all times as to the exact condition of each section.

Each county is governed by a county board, consisting of a representative from each township and village and also from each ward of every city. The county board elects a committee of three to represent it in all matters connected with road work, and also elects a county highway commissioner who has direct charge of all road construction and maintenance work done by the county. Each county highway commissioner has an assistant known as Patrol Maintenance Superintendent who is in charge of maintenance. He visits each patrolman at least twice each week, insuring very close supervision.

The county road committee really acts as a board of directors and a sa buffer between the county highway commissioner and the county board on the one hand and the State Highway Department and the county board on the other.

Prior to the selection of the system authorized by the legislature, our division engineeers made a condition survey of all competing roads showing the actual conditions existing on every mile. After the selection of the system another survey was made, at which time the distance was measured accurately and stakes set each mile locating future mile posts. The information on each mile shows by tenths of a mile the soil, drainage, type of surface and condition. This information was very helpful later on in planning the patrol system in each county.

The law under which we operate did not provide especially for a system of patrol maintenance. It did, however, provide that "each county must adequately maintain the portion of the system lying within the county, according to the specifications, directions and to the satisfaction of the Highway Commission.

A Complete System From the Start

The Commission determined, however, that a thorough patrol system must be installed at the very beginning which would cover every mile on the system, whether previously improved or not. The portion of the system lying in each county was divided into patrol sections by the county committee, acting jointly with the county highway commissioner and our division engineer. The patrolman for each section was selected in the same manner. The county committee advertises in the local press that on a certain day those seeking the jobs of patrolmen for the coming season must report at the county court house. The applicants "if new" are interviewed by the county committee and our division engineer and the most promising candidates are given the positions. Applicants having served as patrolmen one or more seasons are given preference over new men and they usually receive more salary.

Each patrolman enters into a written contract with the county and gives a bond in the amount of $500 for the faithful performance of the work and porper care of the tools and machinery entrusted to him. The contract is also subject to the approval of our division engineer.

On "team patrol sections" the patrolman must furnish a team and wagon satisfactory to the county ,the county furnishing a light blade grader, road planer, plow, slip scraper and miscellaneous small tools. On "motor truck or tractor patrol sections" the county furnishes all the equipment.

The salaries paid on team patrol sections range from $140 to $165 per month for the 1922 season; those on motor truck and tractor patrols average about $110 per month. The season extends from about April 1 to December 1, and from December 1 to April 1; the patrolman agrees to work when requested at a fixed price per hour.

The "team patrol sections" average about 6 2-3 miles each ,and as a rule are confined to earth road sections and those gravel sections that carry light traffic. We have few tractor patrol sections. They average about 12 miles in length and are generally confined to earth roads but are sometimes preferable on heavy traffic gravel roads where heavy maintenance equipment is necessary. Motor truck patrol sections average about 18 miles, and acr economical only on heavy traffic roads where heavy maintenance equipment is necessary and where new material must be hauled regularly, on surface treated stone or gravel, and for work on concrete surfacings. We find thta on earth or gravel sections where traffic does not exceed an average of 200 vehicles per day the "team patrol" is cheaper and more satisfactory than any other.

Maintenance Costs on State Trunk Highways

The 1917 legislature provided for a 5000 mile State Trunk Highway System, which the legislature of 1919 increased to 7500 miles. Table 1 shows the actual miles maintained by patrol methods each year, the number of patrol sections, the salary paid patrolmen, the patrol maintenance cost of each type per mile, and the amount expended per mile out of maintenance funds for "betterments." "Betterments" consist of widening the road and providing drainage with heavy blade grader work, light resurfacing, new culverts, and the cost of marking and signing the system:

During the first month of patrol maintenance in 1918, the actual driving conditions in Wisconsin were improved far beyond the expectations of the most optimistic friends of patrol maintenance. Again when the entire system was adequately marked during the week of June 22, 1918 ,making it possible for one from Illinois, Iowa, Minnesota or any other state to travel the length of Wisconsin without asking directions, our hopes were fully realized and the public expressed their approval of the system in no uncertain terms.

The Results Obtained

The "Wisconsin Idea" from the very beginning has been to "serve traffic." The patrol maintenance plan adopted in 1918, improved upon from year to year, and extended to include additional county highways each year, has certainly "served traffic" better, and satisfied the public to a greater degree than the expenditure of the same amount of money each year in constructing a few miles of high type surfacing would have done.

After five years of patrol maintenance we find that the following conditions prevail:

(1). Every town, city or village in the state is on a well maintained and marked highway.

(2). Traffic is distributed over a large mileage, reducing congestion on many highways.

(3). The average speed of traffic has been increased at least 10 m. p. h., resulting in time saving beyond computation.

(4). Night driving is safe and practical and our traffic census shows a marked increase each year in night traffic. Prior to five years ago, no sane person would think of driving from Milwaukee to our northern lake district during the night (300 miles), while now the practice is becoming very common and popular.

(5). Prosperity immediately becomes noticeable. The farmers along such routes soon vie with each other in promoting neatness in their road fences, farm buildings and entrances. Farm names appear over the gateway and the mail boxes are given a fresh coat of paint. Letterheads even show the location of the farm by Trunk Highway route and mile number. Products of the farm are sold direct to the city dweller at a price satisfactory to both. In the villages and cities along the routes new ‘‘Inns or Tea Rooms,’ rest rooms and garages spring up to serve traffic.

(6). Last, but not least, is the tourist, and our definition of a ‘‘tourist’’ is any person using our highways for pleasure, whether residents of Wisconsin or not. They tell us that we have the best maintained and marked highway system in the world. We realize that nature has provided Wisconsin with scenic features in abundance; nevertheles, the tourist today would not be with us if our highways did not make traveling by motor car a pleasure. It is extremely difficult to estimate the total amount spent in Wisconsin by tourists. From the most accurate data available we are confident that it now exceeds $100,000,000 annually. The little village of Kilbourn, located at the lower entrance to the ‘Dells of the Wisconsin.” containing a population of but 1200 people, furnished us accurate records kept by the banks, hotels and business houses for the 1922 season, showing that over one million dollars was left in that vicinity alone by tourists; also that a count taken by the business mens' association one night registered more people camped in the Village Camping Grounds than were living in Kilbourn. Practically every town on a patrolled highway now provides a free camping ground for tourists.

TABLE 1—COST OF WISCONSIN PATROL MAINTENANCE, 1918-1922

Year	1918	1919	1920	1921	*1922
Actual Miles Maintained......	4,998.9	4,998.9	7,234.0	7,260.4	7,458.59
No. Patrol Sections..........	561	561	791	911	940
Monthly Salary, Team Patrol..	$ 130.00	$ 145.00	$ 165.00	$ 155.00	$ 150.00
Monthly Salary, Motor Patrol.	90.00	110.00	125.00	115.00	100.00
Patrol Maintenance, Cost Per Mile, Earth	135.21	154.01	187.24	196.21	186.40
Gravel	120.80	133.63	184.68	193.85	183.25
Stone and Gravel, Surface Treated	574.21	626.33	706.11	682.23	671.84
**Concrete	162.21	210.41	220.18	322.21	311.85
Cost Patrol Maintenance......	573,042.16	767,302.12	1,220,535.00	1,326,927.24	1,355,900.00
Cost of Betterments..........	396,449.65	488,529.68	756,474.38	1,028,976.04	952,850.00
Cost of Marking and Signing..	7,888.22	17,776.16	28,820.61	20,462.14	41,250.00
Total Expenditures	$977,430.93	$1,273,607.86	$2,005,829.89	$2,381,413.85	$2,350,000.00

The above total expenditures average $278.00 per mile per year.

*Final costs will vary somewhat from figures shown, as the season is not complet eat this date (Dec. 15, 1922).

**Annual costs include all shoulder maintenance, which runs high on all surfacings less than 18 feet.

We are satisfied that during the five years of patrol maintenance, 1918-1922, the tourists have left not less than $300,000,000 in Wisconsin. Figuring a net profit of but 20 per cent., which is very conservative, the profits from this source would be $60,000,000, or about seven times the total expended for patrol maintenance and marking and signing the State Trunk System since April 1, 1918.

We are satisfied with the progress made and the results obtained through our patrol maintenance system during the past five years, but not content. Our patrol maintenance has improved each year and will continue to improve. The surface has only been scratched insofar as marking and signing is concerned. We will abandon the telephone marker as rapidly as possible, replacing them with standard markers placed along the shoulders of the road. Special signs were erected in 1922 at the entrance to each city or village, giving the name and population. In 1923 we will place signs at all lakes and streams, giving their names. Following this, signs will direct the traveler to all scenic and historic places, both on and off the system, giving directions and distances to same. Certain shaped signs will be erected along the shoulder of the road to denote certain dangerous conditions. One shape will indicate ‘‘Stop’’; another ‘‘Slow’’; another ‘‘Caution’’; and another that the highway you are traveling turns either right or left. There is really no limit to the service that can be rendered traffic along this line. We naturally feel a certain amount of pride in our marking and signing, and especially in the marking of all detours around construction work, and the Highway Service Map, published weekly, showing roads open for travel and their condition, also the detours and their condition.

After five years of patrol maintenance, we are confident that the people of our state are completely sold on the plan and are willing to pay for the pleasure and convenience it has given them. The time may come when we will favor direct state maintenance. However, the thorough co-operation of the county officials in actual charge of maintenance and the sentiment developed by them locally for additional patrolled roads and road improvement in general, confirms our original opinion that the co-operative plan of maintenance would result in the greatest good to the greatest number in Wisconsin.

To the thoughtful automobile driver, who has observed the location of advertising signs and noticed how frequently the approach of a vehicle on the cross road is obscured, the necessity for discontinuing the practice of locating large signs at road intersections is felt. Very often it is necessary to observe utmost care in approaching cross roads where the traffic is at all heavy. The efforts of the American Automobile Association toward elimination of such dangerous situations as is created by this practice, are very commendable.

Current Events in the Field of Highway Engineering and Transport

COLORADO ASSEMBLY TO CONSIDER MANY ROAD BILLS

Activities of the State Highway Department During Next Few Years Depends upon Action Taken by Legislators

The Twenty-fourth General Assembly of Colorado, now convened in regular session, has before it a large number of bills, affecting the State Highway Department. Some of these measures affect the department directly, while others are of great interest to the department, because the State Highways and their uses are dealt with by these measures. All of the measures are of the utmost importance, because whatever action is taken upon them by the members of the assembly, in a large measure, depends the scope of the department's activities during the next few years.

Among the measures not directly affecting the department is a group of several bills designed to bring about state supervision of automobile truck and passenger lines operating between fixed points, and on a regular schedule. The authors of these bills all seek to place these automobile lines under the supervision of some authority, though they differ as to the authority. Most of them seek to have automobile lines declared a public utility and placed under the state Public Utility Commission while one bill provides that the commissioners of a county shall have power to grant franchises.

Of interest to highway users and to the people in general is the fact that all of these bills provide for fees for automobiles used in regular passenger and freight service many times hgher than the feeis charged at present for this class of automobiles, the theory of the authors being that the heavy machines used by auto stage lines are not now paying license fees commensurate with the damage done by them.

There are two bills which affect the Highway Department insofar as both seek to insure the payment of the automobile property tax in which the department participates to the extent of one mill. The bills seek to accomplish the same end by different means. One of them declares all unpaid general taxes on an automobile a lien against the machines in question, while the other provides that every county assessor shall furnish the county clerk and recorded of his country with a list of the automobile owners, together with the amount of tax due on each man's automobile.

In the House there was introduced a bill which has for its object the employment by the various counties of a licensed engineer with at least three years' experience for the supervision of road construction and maintenance.

INDIANA REPORTS ROADS IN GOOD CONDITION

Maintenance crews of the state highway department are consistently dragging stone and gravel roads in the state system and as a result this mileage is in an near perfect condition as possible to make it, according to A. H. Hinkle, chief maintenance engineer. The only exception he says is an occasional spot where metal is worn through. However, patrolmen are charged to locate and repair these places as quickly as possible.

Mr. Hinkle said that so far there has been little freezing of our roads. He pointed out that the general spring thaw as a rule begins in southern Indiana about the middle of February, traveling northward and reaching extreme northern eections about the middle of March. It is during such seasons roads are subject to the most severe wear. To combat deterioration and to expedite repair work, huge stock piles of gravel and stone have been placed at advantageous points along state roads. Ift here is no severe freezing weather this wintr a grat dal of cutting up of state road mileage is not anticipated this spring Mr. Hinkle says. Right at the tme the mleage was never better for there has been about the proper moisture to pack roads and hold them firm.

According to John D. Williams, highway director, the commission will spend the least amount possible necessary to keep such state roads open to traffic this winter that are planned to be hard surfaced in the spring. The 1923 program contemplates paving the Indianapolis end of the Lebanon road; Range line road from Carmel to twelve miles south of Kokomo, and for quite a distance both east and west of Fort Wayne on the Lincoln highway. There will be additions to this for the paving program, Mr. Williamis says.

He points out that the Reelesville gap on the National road, one of two remaining unpaved sections on this highway west of Indianapolis, is now being resurfaced with cinders and gravel to keep it open to traffic this winter. Maintenance crews will keep this section open and in the early spring or as soon as weather conditions permit, it will be paved.

MICHIGAN TO SPEND $16,000,000 FOR HIGHWAY WORK DURING 1923

Frank F. Rogers, state highway commissioner of Michigan, announced that the Highway Department has planned an expenditure of $16,253,194 for 1923, which will be used in the improvement of 978 miles of road, of which 490 miles will be Federal aid road and the remainder will be paid for from the state highway bond issue. Three hundred and thirty-four miles of road will be paved. This large amount of work is made necessary by the curtailment of the 1922 program by inconveniences caused by the railroad strike and consequent shortage of materials.

Of the cost of this year's work, $10,000,000 (the fifth and final installment under the present law) will be obtained from the sale of state bonds, while the counties will provide $3,273,791. The coming legislature will be asked to appropriate $4,000,000 for interest on and a sinking fund for retiring the bonds, and also appropriate $2,000,000 for road maintenance and $2,500,000 for state aid on non-trunk line roads.

GEORGE H. BILES RESIGNS FROM PENNSYLVANIA HIGHWAY COMMISSION

George H. Biles, Assistant State Highway Commissioner of Pennsylvania has tendered his resignation to State Highway Commissioner Paul D. Wright, to become effective March 1, 1923.

George H. Biles has been connected with the Pennsylvania State Highway Department since June 23, 1905, entering as Chief Draughtsman. A year later he was appointed Division Engineer and while employed in this capacity he laid out and supervised the construction of many miles of the State's finest highways. He designed and supervised the construction of the famous Lewistown Narrows Model Road, the first highway built under the provisions of the Sproul Main Highway Act; also the notable Riverside Drive extendng northward along the Susquehanna River, out of the city of Harrisburg.

In December, 1912 he was appointed Assistant to the Chief Engineer of the Department, and later Engineer in charge of all maintenance work on the state highways of Pennsylvania. He reorganized the Maintenance Division, which has supervision of over 10,000 miles of roadway and employs 12,000 men at the peak of the season's work.

During the World War, when Acting Chief Engineer in charge of all construction and maintenance work in Pennsylvania, Mr. Biles organized and directed colossal operations in snow removal work, in order to keep the main trunk highways open for the United States Army truck trains, making Pennsylvania the pioneer State in this epochal work. This highly successful operation received national and international attention.

When Governor William C. Sproul took ffice in 1919, and appointed Lewis S. Sadler as State Highway Commissioner, Mr. Biles was appointed Assistant State Highway Commissioner. During that year Mr. Biles conceived and executed the plan for the complete reorganization of the Pennsylvania State Highway Department. During the last four years he managed the largest construction program of modern highways and intensive maintenance ever accomplished in the United States, involving the expenditure of $120,000,000. This organization and its accounting system has been pronounced by the United States Government and leaders the most comprehensive in existence.

George H. Biles was born in Philadelphia, November 7, 1879, and was educated in that city. He is a member of the American Society of Civil Engineers, American Society for Testing Materials, the American Road Builders' Association and the State Highway Officials' Association. He is the author of many technical papers on relative value of various methods of bituminous surface treatment methods and engineering article for leading technical magazines. He also prepared a manual for the use of engineers in highway building and maintenance and has lectured before highway engineering classes in leading colleges in Pennsylvania.

Mr. Biles has, as yet, announced no plans for the future.

ROAD NEEDS OF NATIONAL FORESTS GIVEN ATTENTION

A comprehensive study is now being made of the road needs of the national forests, according to the annual report of the Forest Service, United States Department of Agriculture. The figures available indicate that to complete the necessary system of forest development roads and trails, 13,560 miles of roads and 37,114 miles of trails must be constructed at an estimated expenditure of $64,693,000. For the system of forest highways of primary importance to the States, counties, and communities the rough survey indicates that $107,658,000 must be expended for construction or improvement. If the present current appropriations are continued, it appears possible to complete the development of an adequate road system within the national forests covering all requirements in from 20 to 26 years.

"BUILDING FOREST ROADS," A NEW FILM ISSUED BY U. S. BUREAU OF PUBLIC ROADS

The men, method, and machinery engaged in building good highways through the great national forests of the West are brought to the fore in "Building Forest Roads," a new one-reel motion picture just released by the U. S. Bureau of Public Roads. The picture is one of a series produced by the bureau.

As reasons why roads are needed in the forests, the film shows mineral deposits awaiting machinery for development, mature timber ready for sale when the way to market is open, scenic treasures removed from the beaten track, and the constant menace of forest fires. The engineers map out the route, the clearing crew cuts a right of way through the timber, the dynamiters blast out what looks like the whole side of a mountain, the graders perform their function, bridges are constructed, and finally the roads are given a surfacing, their "cost of armor" against the steady traffic of future years.

"Thus," says the film in conclusion, "are the national forests being opened to use."

The film may be borrowed for limited periods from the department, or copies may be bought by authorized institutions at the cost of printing.

NATIONAL SLAG ASSOCIATION ELECTS NEW OFFICERS

At the Fifth Annual Meeting of the National Slag Association which was held at the Hollenden Hotel in Cleveland, Ohio, Feb. 16th, the following officers were elected for 1923:

President—C. L. McKenzie, Duquesne Slag Product Company, Pittsburgh, Pa.
Vice Pres.—C. E. Ireland, Birmingham Slag Company, Birmingham, Ala.
Secy.-Treas.—H. J. Love, 933 Leader Building, Cleveland, O.

A. [illegible] Goldbeck, Chief of the Division of Tests of the U. S. Bureau of Roads, who was present at the afternoon session, discussed with the producers the elaborate test procedure of the complete investigation of the properties of slag as an aggregate in concrete, which his organization has practically completed. The work was begun in 1919. In all probability the results will appear as a paper before the American Society for Testing Materials in June of this year.

Approximately 85 per cent of the tonnage of commercialized Blast Furnace slag is represented by the membership of the Association.

DELAWARE HIGHWAY CONSTRUCTION MOVES FORWARD DURING 1922

The Delaware State Highway Department, in the face of the general car and material shortage, completed during 1922, 73.6 miles of state highway, or 98 per cent of the mileage under contract. This would be a small program in many states, but when one realizes that this is approximately 2 per cent of the entire road mileage of the state, it is seen to be no mean accomplishment.

Delaware is the second smallest state in the Union and one of the last to become interested in improved highways. Since the organization of the State Highway Department in 1917 rapid strides have been made, however, and in a few years some of her sister states will be obliged to look to their laurels. Preeminently an agricultural state, its proximity to Philadelphia and other industrial centers make it peculiarly adapted to the growing of market produce and fruits, a large part of which are being hauled by trucks over the new state highways direct from the farm to market.

The state highway system was especially designed to handle this traffic rapidly and safely. To accomplish this it was necessary to eliminate the principal causes of speed reduction, viz., congested traffic areas, excessive curvature, heavy grades and railroad crossings.

Portland cement concrete pavement is standard construction in Delaware, 92 per cent of the state system being constructed of this material. Evenness, low tractive resistance, non-ssliperiness in wet weather and freedom from traffic interruption for maintenance repairs were factors in its selection.

The main primary state highway system is now practically completed, and with the further construction of a secondary system reaching the smaller towns and villages and connecting with the Maryland and Pennsylvania highway systems, Delaware will have a thoroughly modern and adesuate system of highways second to none in America.

OUTLOOK FOR ENGINEERING EMPLOYMENT IS BRIGHT

All indications point to a banner year for engineering employment according to the Employment Department of the American Association of Engineers. Resumption of activities after the usual year-end pauuse has started with noticeable effects throughout the country. There is a great demand for engineers particularly designing engineers and salaries for these technical men have taken a broad increase during the past two months. An average increase on starting salaries amounting to over 10 per cent, has become effective in many organizations. The field for construction engineers is beginning to look brighter. By March, construction work will be in fairly good swing.

In a survey made of the country, practically all sections show very little unemployment among professional engineers, a scarcity of men for engineering work, and office men are at a premium. The city of Los Angeles is required to hold up some important municipal projects because of their inability to engage competent checkers on the necessary plans. Conditions on the Pacific coast for engineers are excellent with the exception of the northwest where the winter season has tied up construction work. The southwest section of the country is fair and the mountain states are about balancing the supply and demand. The central states show the greatest activity in engineering work with practically no unemployment and an average of two positions for every competent designing engineer. The southern and south Atlantic states show activities fair with some construction work starting and highway work taking on activity. The eastern section shows some unemployment among engineers at the present time.

TO TEST ACTUAL STRESSES IN ROADS OF MANY STATES

Actual stresses in concrete-road slabs and subgrade conditions beneath are to be investigated in many States by the U. S. Bureau of Public Roads. A truck is now being equipped with suitable apparatus, including graphic strain gauges and an autographic deflectometer especially developed for the purpose. Data to be collected will include soil and moisture condition of the subgrade, design of slab, direction and magnitude of stresses, and deflection of slab under legal limit of loading as well as other loadings.

This investigation is to start early in the spring, and some of the southern States will be visited first. Valuable information should be secured as to the strength of different types of design.

A plan is being worked out by the county highway engineer of Yankton county, S. D., and the county commissioners, to construct gravel roads throughout the county so that no quarter-section of land shall be more than three miles from a graveled road. This could be done, they state with approximately the same tax as that of 1919.

Equipment—Trade—Materials

NEW INSTRUMENT MAKES RECORD OF ROAD SURFACES

An instrument which makes a record of the road surface has recently been perfected and placed on the market. This instrument, known as the Vialog, is a carefully designed compact unit installed on or near the dash. It is built almost entirely of aluminum so that it is light in weight as well as strong in structure. Within the box is a paper chart 6 in. wide driven by a flexible shaft connected to one of the front wheels and the two recording pencils are actuated through connection with the front axle. The paper is furnished in lengths sufficient for the inspection of 11 miles of road. A clutch is provided so that the instrument can be operated or disengaged at will.

As the automobile is driven over the road the chart moves in direct ratio to the distance traveled (1 in. to 50 ft. of road) and the recording pencils resting on the paper make a series of irregular or straight lines depending on the condition of the pavement. In this way the depressions and high spots are located, measured and recorded. The moving paper chart is in plain view of the observer at all times so that notes and topography may be sketched in as the inspection is carried on. This also affords means for measuring the length of the road, locating culverts, ditches, property lines, etc. In fact a very comprehensive survey may be made.

The irregularities in the pavement are also automatically summed up so that the observer at any time may read off the sum of the irregularities passed over by the car. This information may be reduced to inches of irregularities per mile of pavement by a simple calculation. This is found useful in comparing various types of pavement or various pavements of the same type as built in actual practice.

Mr. Harley Dunbar, an engineer in the employ of the New York State Highway Commission, is the inventor of the Vialog and it is manufactured and sold by the Universal Road Machinery Company of Kingston, N. Y.

CARR ROAD FORM

The Carr Road Form, which has just been placed on the market by the Lakewood Engineering Company of Cleveland, Ohio, and which was exhibited at the Chicago Road Show, has a number of distinctive features of interest to every road builder.

The form which is made of 3-16 in. metal has a locking arrangement which consists of two simple wedges and insures accurate and rigid connection of sections. The sections of form are made in 12-ft. lengths, which is 20 per cent longer than has been customary for road forms and decreases the number of joints to be made and the sections to be handled in a given distance.

One of the most important features of the form is the Line Point Top Surface, which is secured by the rounded top. No concrete or stones can lodge here to get under the wheels of the finishing machines or subgrader to cause them to ride high. The form is also practically self-cleaning. Edging is made easier because of the uniform top and smooth joints which result from the rigid connection between sections secured by the wedge members. Flat stakes having a penetration of 18 in. and which can be driven anywhere along the base of the form are another point of superiority. The shape of the stake gives it maximum resistance against displacement.

The base of the form is 5 in. wide and furnishes ample bearing to support the forms when carrying mechanical finishing and subgrading machines. These forms were used on several jobs last season in order to thoroughly try them out before placing them on the market and these jobs proved that the advantages of the form are of real practical value.

"IDEAL SECTION" OF LINCOLN HIGHWAY BUILT AT MODERATE COST

Economy Primary Feature in Construction of Model Stretch; Cost Carefully Considered by Technical Committee in Determining Plans

With the completion of the paving of the "Ideal Section," a model stretch of road built in Northern Indiana by the Lincoln Highway Association with funds contributed by the United States Rubber Company, nation-wide attention has been focussed on the road. A vast amount of discussion upon highway design and specifications has been stimulated. This was one of the aims of the Lincoln Highway Association in building the Section.

The Association has long felt that more public thought should be given to the nature of the improvements resulting from the investment of the hundreds of millions of dollars now going into highway construction in this country annually. According to officials of the Association here the American public, which in the long run is paying the bills, has not taken sufficient interest in the adequacy and permanence of the highways being constructed. Too frequently public ignorance of the problems confronting highway engineers and commissioners has resulted in mistaken public pressure for road improvement which was not properly designed to carry the traffic it would receive. The result has been inefficiency and waste.

The Cost of the "Ideal Section"

The Association states that in some way the impression has gained currency that the "Ideal Section" cost $100,000 a mile. This is not the case. The cost of the reinforced pavement, which by the public is generally considered as the "road," was but $64,897.20 per mile. This for 40 ft. of concrete, 10 in. thick and reinforced with 80 lb. of steel to the 100 sq. ft. It will be noted that for the ordinary 20-ft. width, this road would have cost but $32,450 a mile, even though it was much more heavily reinforced and 2 to 3 in. thicker than the paving now being generally laid in many sections of the country.

Two bridges were included in the Ideal Section link and these two structures cost a total of $23,174.26. These expenditures are by no means extravagant. They represent true economy for the volume and type of travel the Ideal Section of the Lincoln Way was designed to carry.

Additional funds, of course, were spent by the Association in the development of the design, and in the carrying out of the many added features recommended by the Technical Committee. The cost of the landscape work, which involved much preliminary planning it would not be necessary to duplicate if 100 miles instead of but one were beautified, was $4,800 per mile, while the cost of illuminating the Section for night travel was but $4,051 per mile. In handling a project of this character money was necessarily expended on expert engineering consultation and in the infinite amount of red tape required to perfect the arrangements with the Federal Government, the State, and the County and the

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A 12 Week Exhibit of Innovations and Surpassing Beauty to Boost American Industry and Home and City Beautiful Movements, Featuring Good Streets & Roads.

All concerns having products suitable for street and road making and improvements participate in this exhibit.

Ten million visitors in Atlantic City when this show is in progress will see your exhibit.

Exposition folder and full particulars mailed free.

Am. Home & City Beautiful Ass'n, Atlantic City, N. J.

property owners. The benefits of these expenditures are available to any community in the country in the shape of detailed specifications and plans which may be had upon application without expense.

Adequate Width and Strength True Economy

Considering the economy of the Ideal Section's design for heavy volumes of traffic, it should be remembered that maintenance cost will be practically nil for many years, while the original improvement will carry the increasing traffic of the next ten to twenty years without reconstruction.

The cost of a mile of road cannot be standardized. The sum justifiably to be spent in proper improvement varies with every changing location and condition.

The State of New Jersey has expended over $80,000 per mile on the construction of certain sections of the Lincoln Highway. Unless the conditions are fully known, no one can say whether this sum represents the truest form of economy or the utmost extravagance. The Lincoln Highway in New Jersey carries, in addition to the heavy volume of local traffic the ponderous trucks operating out of Baltimore, Philadelphia, New York and Boston, and the through traffic from the South and West, reaching New York from Philadelphia.

CHINESE WALK MILES FOR A MOTOR RIDE

"It is no uncommon thing for a poor Chinese to take an automobile bus ride for a couple of hours and then walk back home because he can not afford the return journey," says Trade Commissioner William I. Irvine, of the Department of Commerce, just back from a tour of investigation of the automotive markets of Asia. "From this you can conclude safely that education of the Chinese into the joy and utility of the motor vehicle is not a thing of the distant future. What the Chinese do need is roads, and they are being built, under far from propitious conditions, and the automobile is the cause."

"The desire to ride in motor vehicles is responsible for at least 90 per cent of the road construction that is now going on in China. Here is how it works out: A group of Chinese are attracted by the bus idea; there is no road, but by paying kumsha to the authorities they secure the right to construct one. Usually it is a dirt highway, and the builders are given an exclusive franchise to operate vehicles over it. Part of the revenue collected from fares goes for protection. The road then becomes a toll road and everybody using it has to pay for the right. The rich as well as the poor ride in the busses and it is not long before some of the really rich decide to buy a car for themselves so that they can ride over the route in splendor and comfort instead of in a jam. Once the rich man has a car of his own he wants to go farther than the bus road will take him, and his interest in the extension of the road is aroused. And so it goes on progressing in geometric ratio; every car means more miles of road and every mile of new road means more cars, the area of automobilism widening until some day, though probably in the far future, China will be as well provided with motor highways as the United States, and her painful transportation problem will be solved."

OFFICIAL PROPOSALS

STATE OF MARYLAND

STATE ROAD COMMISSION

Notice to Contractors

SEALED PROPOSALS for oiling 5 sections of State Highway, requiring approximately 576,127 gallons of oil, as follows:

Dist. No.	Counties	Miles	Gals.
1 & 2	Cecil, Queen Anne, Somerset, Talbot, Wicomico, Worcester	24.76	48,381
3	Montgomery and Prince George	35.10	66,145
5	Carroll, Frederick, Howard, Montgomery	111.01	213,976
6	Garrett, Allegany, Frederick, Washington	60.45	120,912
4 & 7	Anne Arundel, Baltimore, Harford	57.35	126,713
		288.67	576,127

will be received by the State Roads Commission, as its offices, 601 Garrett Building, Baltimore, Maryland, until 12 M. on the 6th day of March, 1923, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans will be furnished by the Commission upon application.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred ($500) Dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

BY ORDER of the State Roads Commission this 21st day of February, 1923.

JOHN N. MACKALL,
Chairman.

L. H. STEUART,
Secretary.

QUALITY Kinney EFFICIENCY

PERFECT APPLICATION
HEATER and DISTRIBUTOR
will heat and apply all varieties of bituminous products now in use for road construction and maintenance.
GET OUR CATALOG
KINNEY MANUFACTURING CO.
BOSTON, MASS.
New York Houston Chicago San Francisco
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STANDARD Asphalt Products

Standard Asphalt Binder A *for surface treatment.*
Standard Asphalt Binder B *for penetration work.*
Standard Asphalt Binder C *for the mixing method.*
Standard Refined Mexican Asphalt *for sheet asphalt paving.*
Standard Asphalt Joint Fillers *for brick or block pavements*
Standard Paving Flux, Standard Bridge Asphalt and Preserving Oils.

STANDARD OIL CO. OF NEWYORK
26 Broadway

Specifications and all other particulars furnished on request.

SO NY SOCONY ASPHALTS AND ROAD OILS

ROAD BUILDERS' EXCHANGE

Reasonably **ROAD BUILDING PLANT** Priced

1 Austin, 10 ton, crane, mounted on caterpillar traction, and driven by Buffalo Gasoline engine, 40 ft. boom.

1 8½ D. D. Acme crusher, 12x16, elevator, screen, portable bin and 20 H. P. gasoline engine.

1 Haiss wagon loader, gasoline driven.

1 Erie, type "B" combination crane and shovel.

2 75 H. P. locomotive type boilers, on skids.

1 100 H. P. locomotive type boilers on skids.

1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.

1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.

1 7x10 Lidgerwood DC DD hoist and boiler.

1 7x10 Lambert DC DD skeleton hoist.

24,000 ft. Lakewood 24 in. ga. 20 lb. portable track, 15 ft. sections, with turnouts complete.

50 Batch box cars and 80 cu. ft. batch boxes.

4 6 ton, 24 in. ga. Whitcomb locomotives.

4 6 ton, 24 in. ga Cummings locomotives.

2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.

2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.

1 Foote Paver, Shop No. 1484, self-propelling, steam driven, 2-bag batch; overhauled ready for work.

1 14-E Rex Paver, caterpillar traction.

1 No. 11 Koehring Paver, wheel traction.

3 Lakewood sub-graders.

1 7 ton guy derrick, 70 ft. boom.

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Advancing Our Highway Research Program

How Individual Organizations Can Fit Their Work Into a Broad Plan

By W. K. HATT

Director, Advisory Board on Highway Research, National Research Council

IN order to determine what each can do to expedite the collection of authentic data on the basis of which highways may be wisely selected to meet the economic needs of the region properly built to conform to the economics of the situation, and operated in the interest of the public, the immediate necessities may be outlined:

(1.) Many problems in highway engineering are accompanied by corollary problems in economics of highway transport. For instance: What sum may profitably be spent in capital costs of construction to reduce a grade? The answer must depend on volume of traffic and on operating costs of road and vehicle. Again, decisions upon changing second-class into paved roads involve cost of road maintenance, tires, gasoline, and repairs and depreciation to vehicle, etc. The reduction of operating costs due to improved surfaces are large on roads of heavy traffic; How heavy? The reflex action of improved alignment on change of design of vehicle also suggests itself. Reliable data appear to be largely wanting. Research activities should be pushed.

(2.) The study of methods of financing road construction and the distribution of the expense between those benefited, awaits fact-finding surveys. The study itelf need the services of trained economists. The sources from which the tax dollar comes, and its distribution among roads, education, charities, etc., should probably be determined.

(3.) Studies of the effect of highway improvements on land values are needed; and also of the effect of highway improvements upon industry and the development of typical regions such as truck farming or resort areas. The results of such studies will be a guide for similar areas under development.

(4.) The laws governing the growth and dispersion of traffic, and the mechanics and psychology of safely handling such traffic in congested areas, need study by research methods.

(5.) The purpose and methods of, and the instrumental equipment for, basic traffic surveys upon which state construction and maintenance funds may be allocated is a live isue. A simple instrument for automatically counting and weighing traffic is now under development in the U. S. Bureau of Public Roads.

(6.) The large volume of valuable data, accumulated at the cost of hundreds of thousands of dollars, through studies of oil properties, effect of loads and strength of slab—data that underlie the as yet undisclosed principles of the mechanics of slab design, should be brought together and analyzed to uncover the principles of action. The instrumental equipment and technique in this field represent a remarkable advance in the science of measurement. With the mechanical principles determined, then the engineer can be given formulas for fitting the road to the load. If these principles are still hidden, final coordinated researches should be planned to settle these questions. If it is true, as it seems to be, the thinner at the center, what should be the proper distribution of the thickness, and how should slabs be reinforced to provide longitudinal stiffness?

(7.) The economics of pavement types in specified situations must be learned from carefully gathered data, so that decisions may be made less upon ex-parte arguments and more upon exact information.

(8.) The findings of laboratory tests upon materials of construction should be scrutinized in the light of experience in operation to determine to what extent these tests are predictive of service value in the road. Studies of the destructive action of alkali and sea water upon concrete structures are of interest to highway engineers.

The above problems are pressing for early solution. Research is not only of direct daily use, but is insurance. It is not too much to say that there must be created a new realm of economic data to quiet opinionated discussion of mooted questions in the field of highway transport. How can issues be settled or college courses in highway transport be established except on the basis of scientific information, gained from surveys of existing traffic and collection of data of costs of operation of road and vehicle, maintenance data, study of taxation and benefits? The end may be reached by.

(a) Evaluating the present information.

(b) Planning new researches where needed.

Abstract of a paper presented at the annual convention of the American Road Builders' Association, Chicago, January 16-19, 1923.

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(e) Publishing authentic data as fast as they are accumulated.

During the development of highways in the past years, various voluntary organizations have arisen to meet needs and influence politics. The existing list of organizations discloses cases of duplication of effort and indefiniteness of purpose. More recently organizations have entered the field with some official status and legislative duties, and possibilities of expansion to greater power, such as the American Association of State Highway Officials.

Grouping of Organizations

It is a difficult task to select a group of organizations signally prepared to carry on specific researches. However, the following list includes organizations operating in well defined fields, and which, taken together, fill the needs of highway research to a fairly satisfactory degree:

A. PRODUCTION OF RESEARCH DATA:
   1. Research Program and Coordination: Advisory Board on Highway Research.
   2. Mechanics and Psychology of Traffic Signs and Codes: Eno Foundation.
   3. Vehicle Design and Operation: Society of Automotive Engineers, Bureau of Standards.
   4. Structural Design of Roads: Bureau of Public Roads, State Highway Commissions, Universities.
   5. Maintenance Studies: State Highway Commissions, Bureau of Public Roads.
   6. Character and Use of Materials: Bureau of Public Roads, State Highway Commissions, Bureau of Standards, Universities, Industrial laboratories, State geologists.
   7. Basic Traffic Surveys: State Highway Commissions.
   8. Highway Transport Studies: Bureau of Public Roads, State Highway Commissions, Universities.
   9. Economics of Location Road Resistance, and Power Requirements as Affected by Alignment and Surface, and of Operation Factors: Bureau of Public Roads, State Highway Commissions, Universities, Society of Automotive Engineers, Bureau of Standards, U. S. Army.
   10. Construction Plants: American Road Builders' Association, Associated General Contractors, State Highway Commissions, American Society of Mechanical Engineers.

B. COLLECTION OF STATISTICS:
   1. Cost of Transport: (a) Road: Bureau of Public Roads. (b) Vehicle: Society of Automotive Engineers, National Automobile Chamber of Commerce, Associated General Contractors.
   2. Theory of Finance: Departments of Economics of Universities, Bureau of Public Roads, State Highway Commissions.

C. STANDARDS OF REGULATION AND RECOMMENDED PRACTICE:
   1. Methods of Testing Materials: American Society for Testing Materials, Association of State Highway Officials, Bureau of Standards, Bureau of Public Roads.
   2. Structures: Bureau of Public Roads, Association of State Highway Officials, American Society of Civil Engineers.
   3. Standard Plans for Road and Records: Bureau of Public Roads, Association of State Highway Officials, American Road Builders' Association.
   4. Use of Road: Association of State Highway Officials, National Highway Traffic Association, National Automobile Chamger of Commerce.

D. COORDINATION OF TRANSPORTATION AGENCIES: Bureau of Public Roads, U. C. Chamber of Commerce, National Automobile Chamber of Commerce, Interstate Commerce Commission, Department of Commerce.

E. EDUCATION IN COLLEGES AND COMMON SCHOOLS: Highway Education Board, Association of Land Grant Colleges.

A glance at the above lists of subject matter and agencies will indicate that the U. S. Bureau of Public Roads and the state highway commissions and universities are the three active agencies in the production of research data. Through the Advisory Board on Highway Research these three agencies are closely in touch with each other's work and pursue a unified purpose.

The most useful service of the U. S. Bureau of Public Roads is in fundamentals in the discovery of broad principles and general properties, and in the development of the technique of highway research applicable to the entire country. The universities can cooperate in the research problems of the state highway commissions because their special equipment and expert staff are prepared for such service, and because they are zealous in industrial dvelopment of the states. The state highway commissions are much better prepared than are the universities for the routine business of reception tests of materials.

In the fields of vehicle design and operation the chief agencies must be the Society of Automotive Engineers and the Bureau of Standards. It is increasingly evident that the highway engineer and the automotive engineer must work more closely.

Of the 27 agencies listed, some are not directly operating in the production of research data. They deal with policies, with education, or with standards, the foundation of which however, must be the research data. These agencies follow the general psychology of the human being, viz. an instinct for action, even the absence of information necessary for wise judgments. Indeed, in the pressing necessity for roads to discharge existing traffic, it is not to be hoped that research will ever catch up with construction and use. Indeed the need for research is only seen when use develops problems. However, we must remember that our program of highway construction is not near its peak activity, and the use of research in saving construction and operating cost has yet a wide field for application.

Function of Advisory Board on Highway Research

The large number of organizations for highway research shows real need of such an agency as the Advisory Board, first of all to determine the status of several fields of research to determine if each has been sufficiently occupied, then to plan and stimulate researches in fields that need occupying, and to coordinate the programs.

For example, during the past year a conference was called by the Advisory Board and attended by the various researches who are measuring the resistance of the road to the translation of vehicles, in order that some definition might be reached of the purpose of such experiments, and of the limits of the fields of work of the highway engineer and the automotive engineer. In this conference it appeared that the object of these experiments was to determine the rolling and air resistance to the passage of vehicles over highways of various alignments and surfaces. It also appeared that the existing data of road resistance was sufficient for the purpose.

The automotive engineer in turn should determine by laboratory tests the power characteristics of the vehicle, and the fuel, oil and grease consumption, from which the performance of the vehicle can be calculated on various surfaces and grades, and the excess power for trailers determined to a substantial accuracy. The other operating costs of repairs, depreciation, etc., can best be determined by statistics of average costs collected for types of vehicles in regions containing homogeneous classes of roads. Upon the assembled data the locating engineer can adjust capital expenditure to operating costs for a predicted traffic.

Through the Committee on Structural Design of the Advisory Board a conference was held of those responsible for the three major researches upon structural design of roads, at Pittsburg, California, the Bates road in Illinois, and the Bureau of Public Roads experimental work at Arlington Virginia. At this conference the content of these researches and the apparent indications were discussed and suggestions for useful extension of the program accepted by those in charge.

Bulletin No. 21 of the National Research Council entitled "Highway Research Projects in the United States," gave the results of a survey of the various research projects now under way throughout the United States. The projects were divided both geographically and as to subject matter, and each one described in such a way that the reader might know the purpose and nature of the experiment. Such a survey serves two purposes: first, to put individual researchers into communication with each other so that the methods and instruments might be comparable; and second, so that one state might be saved the expense of seeking an answer to questions that had already been answered in the neighboring state. An additional service of the bulletin will be the indication of fruitful fields of research to those agencies who have the will to work and the means of accomplishment.

The Field of Highway Research

A broad consideration of highway research would lead to a twofold division; first, *a study of materials* going into the roads and the design of sections to the end that they may be mechanically fit to withstand the forces coming upon them from climate and traffic; and second, the *economic data of costs of transportation*, not only to permit a wise location of roads to fit the economic needs of the region, but also to serve to educate the public whose judgment must finally determine the progress of highway construction. For instance, the data obtained at the Iowa State College of the relative operating cost of traffic over dirt roads and paved roads, and the ex-

(*Continued on Page* 79)

Have Large Expenditures Changed the Public Attitude Toward Highway Development?

By S. E. BRADT

Formerly Superintendent of Hihways in Illinois

ONE of the most insistent demands for a reduction in highway expenditures comes from the farmers; and is due to heavy losses sustained by them during the last two or three years, and which are caused by the readjustment of farm prices. This is apparent chiefly in the agricultural states lying west of the Mississippi river, where the loss seems to have been felt the most keenly. The agricultural states lying east of the Mississippi river are strongly industrial and at the same time the farmers in these states have been less affected by the depression. As a result in this section the average sentiment among all classes for continuation of present expenditures is favorable. The farmers as a class are one of the chief beneficiaries of highway improvement; hence their attitude where unfavorable should be only temporary, and undoubtedly will be reserved with the return of equalized farm conditions.

Another influence which has had its effect upon the attitude of the public, is the national policy of retrenchment in expenditures which Congress very properly inaugurated, involving the cutting down of appropriations wherever possible, including those for highway improvement.

While the amount formerly appropriated for this purpose was small in comparison to the economic value of the work and small in the proportion paid by each tax payer, yet we consider it proper that highways should stand a reduction in common with the appropriations for other governmental activities.

My investigation discloses the fact that in some of the Western States having a large area and hence a large road mileage coupled with a small population and a small assessed valuation, there is a tendency to demand lower taxes for highway purposes. In these states the revenue received from motor license fees is comparatively small, due to a small population and few cars; and hence the burden for road improvement comes as a direct tax.

It is probably true that most reactionary tendencies have their foundation in taxation. Whether it be the attitude of the farmer or the tendency towards retrenchment at Washington, it all has its source in the problem of the reduction of taxes.

One of the most potent influences bearing upon the attitude of the people towards this question of highway development is the method by which funds for this work are provided. The demand for reduced taxation, which I have cited, is practically all aimed at general taxation; and consequently there is a movement towards a heavier share upon the users of the road, either through increasing motor fees or through a gasoline tax. The fact that the tax is paid by the same people regardless of whether it is a general tax or motor license fee does not seem to alter the situation. This form of taxation is favored because it is the most equitable and most willingly paid. It is generally admitted that the direct saving to the individual arising from the improvement of the highways is very much greater than the amount paid by him through this method of taxation. In fact it is a question whether these fees should even be considered taxation until they have gone beyond the point where the amount paid exceeds the actual saving. I feel that in many states we can place a larger share of the cost of the roads upon the users and thus reduce, if not eliminate, the opposition because of high taxes.

There is one place wherein the sentiment opposed to highway improvement is not closely related to the matter of taxation, and that is the sentiment that arises from the competition between the motor vehicles and the railroads which is finding considerable backing in the financial press. When you consider that we have approxi-

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Abstract of a paper presented at the annual convention of the American Road Builders' Association, Chicago, Jan. 16-19, 1923.

mately ten and a half million passenger cars and one and a half million trucks in the United States, it becomes apparent that these motor vehicles are taking a vast amount of business which but for their existence would go to the railroads.

The past twenty years has seen little expansion in our railroads beyond that of increasing the number and weight of their locomotives and the carrying capacity of their rails. Traffic demands have increased greatly during this period and now exceed the expansion brought about by those methods. Practically none of our large systems are able to handle promptly the business that is offered them today, and this in the face of the large amount of traffic carried by the motor vehicles.

It is undoubtedly true that the truck has not yet found its economic place in the handling of the freight of the country; but it is generally recognized that it is limited to the short-haul business. This is chiefly the work it is doing today and probably the field to which it will be economically confined in the future, leaving the long-haul business to the railroads as their particular field, which I believe is the more desirable so far as the railroads are concerned.

There are undoubtedly short systems of railroads covering thickly settled areas which under present arrangements are barred from the long-haul business and which will suffer more from the motor traffic competition than the larger systems. The solution of this problem is one to be worked out by the railroads themselves, and may be found in the suggestion of combining all of the railroads of the country into 18 large systems, as suggeted by the Interstate Commerce Commission in compliance with the Transportation Act of 1920.

An Adjustment Necessary

That the motor vehicles can be removed from competition with the railroads is impossible. It will therefore be necessary for some adjustment to be reached under which each will fulfill its proper economic function. The condition of our highways will enter largely into the question of this competition between the motor vehicles and the railroads.

We frequently see the statement in the press to the effect that the chief function of the motor truck should be to act as a feeder to the railroads. This could be influenced chiefly through improving our secondary roads leading away from the railroads in preference to our main roads. It is undoubtedly true that the greater part of the improved mileage of the country is parallel to the existing railroads. These highways should be improved because they serve the greatest number of people. The highway data indicates that approximately 65% of the motor traffic is from town to town. Railroads and interurban lines in laying out their systems took the shortest distance between these towns. For the same reason the highways were located so as to connect these communities with the least possible highway mileage; which means the paralleling of the railroads.

The improvement of our highway is well begun, and will not be finished until not only the parallel roads but the roads leading directly into the country and away from the railroads are also improved in accordance with the requirements of the traffic. All roads are feeders to the railroads whether parallel thereto or extending away from the railroads. At this time a very considerable part of all of our products are hauled to the railroads by motor truck regardless of the state of improvement of the roads.

Highway funds today are being distributed about equally to the main roads and to the secondary or connecting roads and this should continue. To confine this expenditure exclusively to the connecting or secondary roads leading away from the railroad centers and eliminate the main roads which are the ones principally used by the entire traveling public would be a grave injustice to the public and would not receive its support.

Again, the secondary roads would involve at least 90 per cent of all the roads of the country and carry less than 40 per cent of the traffic. This fact brings out more prominently the injustice of giving them priority of improvement over the main roads. However, could this priority be awarded to the secondary roads it would only delay the time when the question of the co-operation between the motor vehicle and the railroad must be settled. The motor vehicle is here and cannot be denied a place in our transportation problem. It is today both a feeder to and a competitor with the railroads. It remain for the future to work out the problem of the proper co-operation between the motor car and the raiload.

Large Bond Issues Necessary

While the expenditures of the past few years for highways has been large in comparison with that of former years it is small in comparison with the investment in motor vehicles now in operation. Figures compiled by the Office of Public Roads gives the total expenditure for highway improvement during 1910 to 1921 inclusive as $2,526,000,000; while the investment in motor vehicles in use at the close of that period was $8,322,000,000. The highway expenditures for 1922 are not yet available, but the approximate motor vehicle investment on the 12,000,000 cars now in use is approximately $10,000,000,000. I would also call your attention to the fact that the owners of the 12,000,000 motor cars in the United States with their families together with those engaged in the motor vehicle business constitute approximately 50% of our entire population. These are the people who want better highways, and who pay the cost, regardless of whether the money is raised by general or special taxation, and who are the impelling force back of the highway movement.

Geographically speaking, the sentiment for retrenchment and for the carrying on of present expenditures seems to be divided by the Mississippi river. In the states lying West, with but few exceptions, there appears a pronounced tendency towards a reduction in the general taxes including that for highways. In the states lying East of the Mississippi river, where the largest programs of high class paving have been and are being carried on, the surface sentiment appears to favor a continuation of about the present annual highway expenditure; but in no state is there a demand for largely increased expenditure.

I have called attention to some of the general influences affecting the attitude of the people towards highway development, both favorable and unfavorable; viz., the present agricultural depression; the attitude of Congress in national expenditures; the combination of large road mileage and small assessed valuation in some of our western states; the competition between the motor car and the railroads; the methods by which funds are raised for highway expenditure; the great number of motor vehicles in use today and being manufactured annually; together with the vast number of our citizens of all classes who are owners and users of these motor vehicles, and hence directly interested in highway development.

I have not touched upon the local influences which bear on the question and which are found in nearly every state and are peculiar to that state. They arise from differing causes; the state highway laws, whether favorable to highway development or unfavorable; politics using highway policies or highway taxation as an issue to bring about personal ends; the use of some particular form of financing to excess for example; the State of Oregon where bonds have been issued equivalent to 4% of the property valuation and which has caused a temporary sentiment against highway work, especially financed in that manner.

My conclusion, after reviewing all of these influences, is that the large highway expenditures of the past few years in themselves have not caused any reaction in the road movement; but that the reaction which we see is due largely to other causes which I have enumerated. These causes are a part of the general underlying and wide spread demand for the reduction of taxation, both national and local. They are real in the minds of the people and should be given careful consideration by those charged with the duty of formulating highway policies in the various states.

Advancing Highway Research

(*Continued from Page 77*)

periments at the University of Michigan clearly show the savings to the people of the state through the paving of roads.

Nor must we narrow the field of research to the purely engineering factors of the highway problem. Theories of finance resulting from experiences in other fields of public undertakings willl be applicable to problems of highway finance. Commodity surveys, to determine just what use is being made of the highways, are necessary for wise judgments upon the relation of the building of highways to the transportation needs of the nation. It is these broad fields of public policy that are particularly important just now in respect to the prosecution of research.

Activity in constructing and in testing constructions runs far ahead of analysis. The gross or surface appearance of experiments is not always reliable, and it is only after the careful analysis of data of deformations from various standpoints that the underlying truths appear. A proportion of the money now spent in research could profitably be devoted to the financing of a corps of analysts who would scrutinize the marshalled data and determine the issues involved. Such an organization of analysts should be provided either for the Advisory Board on Highway Research, or for the United States Bureau of Public Roads.

Another need is for a publication for the findings of research after the work of the analysts has been completed and the committees have met. So much valuable data and reports lie buried in the files of the state highway commissions, the industrial organizations, federal departments and universities.

I can think of no more useful service to be performed by the organizations connected with highway construction than contributions to some agency for the purpose of the analysis and publication of the large volume of data now available. The subject seems important enough from the national standpoint, because the cost of highway transportation is estimated at 7 to 8 billion dollars a year, which is one-tenth of the national income. It would justify the support by some of the many foundation funds now devoted to the study of various economic and scientific problems. It is of course difficult to interest such bodies in work of this kind which seems to most persons to be only in engineering and industrial fields, and to lack that human appeal which accompanies a study of public health and the problems of government. The various organizations represented at this convention have live contact with potential sources of support of such an agency. It apparently needs only a group of individuals who will arrange that the work of the Advisory Board on Highway Research will be adequately financed for a period of five years. In this way the acknowledged potentialities for useful service of our committee will be realized and the collection of data and analysis be expedited in the interest of highway development.

Cost of Pavement Repairs in Newark, New Jersey

By J. W. HOWARD

NEWARK, New Jersey, is a manufacturing city of 500,000 population. It has heavy traffic of motor vehicles not only within it, but connecting it with Newark, Philadelphia and New York. The streets are well paved and kept in good repair. The cost of repaving or maintaining each kind of pavement is analyzed and tabulated so as to eventually determine what kinds of pavements are most economical.

The Annual Report for 1921 of the Director of Public Improvements shows the cost of repairs per square yard of pavement bases and of surface layers separately and added together. The total paved streets on December 31, 1921, was 282 miles. The principal kinds of pavements are shown in the table below.

The city has an excellent municipal asphalt paving plant equipped with storage bins, conveyors, steam rollers and street tools. This plant cost $76,355, not including the land. This plant repairs all old asphalt pavements and lays some new ones on new locations. The cost of repairs made by the City Plant in 1921 to the pavements which have passed the five year guaranteed periods of the original contractors is shown in the following table:

COST OF 1921 PAVEMENT REPAIRS BY NEWARK, N. J., CITY ASPHALT ETC. PLANT

Kind of Pavement	Surface Layer Sq Yds.	Surface Layer PerSq.Yd.	Concrete Base Sq.Yds.	Concrete Base Per.Sq.Yd.	Total Both*
Sheet Asphalt ..	51,499	$1.8126	3,979	$2.3313	$4.1439
Granite Block ..	27,815	1.5262	1,131	2.6651	4.1913
Brick	6,679	3.4968	3,236	4.1820	7.6788
Asphalt Block ..	126	4.2169	59	2.9908	7.2077
Wood Block	4,168	4.4164	3,487	1.5341(v)	5.9505

*Total Both—means where surface and base were repaired at same locations.

(v) Repairs to base of wood block pavement consisted of replacing injured one inch mortar cushion with another on the existing good six or eight inch concrete base below.

Current Events in the Field of Highway Engineering and Transport

FRANK PAGE NOMINATED PRESIDENT OF AMERICAN ROAD BUILDERS' ASSOCIATION

Frank Page, chairman of the State Highway Commission of North Carolina, has been named by the nominating committee of the American Road Builders' Association as president for the 1923-24 year. Other nominations include: For vice-president, E. L. Powers, W. F. Keller, S. F. Beatty, and Samuel Hill; for treasurer, James H. MacDonald; for directors, one-year term, J. R. Draney, W. A. Van Duser, and Frank Sheets; for directors, two-year term, E. J. Mehren, I. W. Patterson, William R. Smith, H. K. Bishop, J. H. Cranford, C. M. Babcock, and H. S. Carpenter; and for directors, three-year term, S. T. Henry, R. Keith Compton, Fred A. Reimer, Charles M. Upham, H. G. Shirley, Will P. Blair, and Frank Terrace.

NORTH CAROLINA GENERAL ASSEMBLY VOTES $15,000,000 FOR ROAD CONSTRUCTION

By a vote of 85 to 9 in the House and of 39 to 2 in the Senate the General Assembly of North Carolina passed the road bill introduced by Representative Clayton Moore, of Martin County, which adds $15,000,000 to the $50,000,000 appropriated under the Doughton-Connor-Bowie Act by the 1921 Legislature.

Briefly, the bill provides an additional appropriation of $15,000,000 and places a tax of 3c per gallon on gasoline and other motor vehicle fuels. It is estimated that the latter tax will bring in an annual revenue of approximately $2,500,000 per year, making a total revenue, with the income from the registration of motor vehicles, of about $5,500,000 per year. This tax places the burden of paying for North Carolina's roads in the proper place which is upon the motorist, the man who uses them. Income from this source is used to pay the interest and sinking fund on the bonds issued for road construction and, after the operating expenses of the Automobile License Department of the Secretary of State's office are deducted the balance is turned over to the State Highway Commission for use in maintaining the State system of roads.

MONTANA ASKS FUNDS FOR FOREST ROADS

Representatives of several counties of western Montana recently met with the State Highway Commission and representatives of the federal bureau of roads and the forestry service and petitioned for appropriations from federal forest funds for road construction aggregating $1,500,000. This money, if appropriated, will not have to be matched by state or county money, but it was said that only a small part of the amount petitioned for would be available this year. Highway Commissioners Geo. W. Lanstrum of Helena and H. A. Templeton of Great Falls represented the board. Representatives of the federal road bureau and forestry service were District Engineer C. H. Purcell and Assistant District Engineer J. A. Elliott, both of Portland, and W. H. Lynch, senior highway engineer of Helena, all of the United States bureau of public roads; Fred Morrello of Missoula, district forester, and H. A. Calkins, of Missoula, engineer of the forestry service. John N. Edy, chief engineer of the highway commission, also was present.

ILLINOIS TO SPEND $2,000,000 FOR OILED ROADS

The oiling programs made by the various counties of Illinois called for an expenditure of over $2,000,000 for 1922, and indications are that the expenditures will be materially increased during 1923, says a recent bulletin. The laboratory inspected over 35,000,000 gal. of oil during 1922—3,000,000 gal. for one county alone.

The laboratory made many field inspections which brought out the following considerations: "The first requisite to a good jb of oiling is a road surface free from pits, ruts and dust. There was noticed a tendency to spread the oil over too great a mileage in two ways —first by oiling a narrow strip in the center of the road and second by using thin oil having low viscosity and low asphaltic content. Either of these practices defeats the purpose of oiling."

COLORADO APPORTIONS HIGHWAY FUNDS FOR 1923

The Colorado State Highway Commission has apportioned $6,777,596 for construction of highways in 1923. The report of the highway advisory board has been approved by the governor of the state. Of the total to be spent, $3,161,691 represents entirely new construction, the remaining sum being left over from the previous three years. Federal-aid projects total $5,272,700 and state projects, $1,494,896.

GOVERNOR SILZER OF NEW JERSEY NAMES NEW HIGHWAY COMMISSION

In accordance with the passage by the New Jersey legislature on Feb. 13 of the new law creating a bipartisan state highway commission of four members, Governor Silzer has sent the following nominations to the Senate: General Hugh L. Scott of Princeton, republican, two years; Percy Hamilton Stewart of Plainfield, democrat, two years; Walter Kidde of Montclair, republican, four years; and Abraham Jelin of New Brunswick, democrat, four years.

ROAD WORK PROGRAM IN NORTH DAKOTA

The 1923 program of the North Dakota Good Roads association, as outlined in a recent bulletin issued by the associaotion, will involve 2,400,000 cubic yards of excavating, 2,500 culverts, 50 or 60 small concrete bridges and 210,000 yards of gravel. Since 1919 2,082 miles of road have been begun or built in North Dakota, and with other highway projects have cost the state $7,244,565, of which $3,352,970 has come back as federal aid.

BUTTES BRIDGE IN COLORADO OPEN TO TRAFFIC

The Buttes bridge over the Fountain River on the main road from Colorado Springs to Pueblo, has been finished and opened for traffic. It consists of two 150-ft. steel truss spans on concrete abutments. It supersedes a concrete arch bridge which was washed out during the floods of June, 1921, through undermining of the foundations.

The contract for the new bridge was let to the Pueblo Bridge and Construction Co. The steel work was fabricated by the Hansell Elcock Co., of Chicago. Work was begun Jan. 13, 1922, and reported completed Jan. 15, 1923. The bridge was built as Federal Aid Project No. 161. Final inspection by the government representative was satisfactory.

PAVING COSTS ADVANCE

A comparison between paving contracts recently let at Platte, S. D., and those let at Yankton, S. D., last spring indicate, it is reported, an advance of about 17 cents per square yard. The Platte contract for vibrolithic pavement was signed at $2.90 per square yard. For comparison purposes it is noted that for the standard concrete pavement similar to the Yankton specifications the bid price was $2.61 per square yard. Deducting the difference in freight rate between Sioux Falls and Platte and Sioux Falls and Yankton, which is 28 cents per square yard, the price would be $2.25 at Yankton as compared with the $2.06 bid accepted by Yankton last spring.

IOWA HIGHWAY COMMISSION RECOMMENDS NEW ROAD LEGISLATION

The highway commission of Iowa has recommended that the state legislature enact the following legislation:

That the right of way for primary roads be paid for out of primary road funds instead of from the county road funds, which is raised by direct taxation.

That some dangerous railway crossings within cities may be eliminated with the help of the primary road funds and approval of the highway commission.

That a gasoline tax be levied on gasoline within this state and proceeds used for the construction and maintenance of highways.

That the commission be authorized to purchase eighteen acres of ground within the city of Ames, where present truck sheds and highway commission equipment is now stored, with easy access to railway transportation, option on which ground is held at $12,000.

That as some counties have been issuing bonds without a vote of the people for funding county road and bridge building enterprises, it is recommended that the law be changed so as to require approval of such bond issues by some state authority before they are sold.

That surfacing of highways and secondary road projects may be financed by local communities where necessary.

That motor trucks and motor bus lines used for freight and passenger service be placed under the authority of the state railroad commission as common carriers, and be required to pay an occupational tax that will in a measure pay for the damage which such vehicles do to the highways.

That since the present primary road law was enacted the U. S. congress has passed a new federal aid law which requires that maintenance of federal roads shall be under the direct control of the state highway department. At present such maintenance is under the county boards of supervisors except where roads are paved. The new federal aid law requires that federal aid highways shall be surfaced in a manner suited to the traffic on such highways and that the state highway commission shall have the power to determine and select the type of surfacing of such highways. Under the present state primary road law the state highway commission has no power to initiate any road improvement project. Such power is in the hands of the county boards, and the county boards have no power to pave highways without a vote of the people. It is recommended that the primary road law be amended to conform to the federal aid law.

NEW YORK STATE TO PLANT TREES ALONG HIGHWAY TO HONOR SOLDIER DEAD

Two thousand elm trees will be planted on the road between Syracuse and Utica early in the spring as the possible beginning of a "road of remembrance,." extending from New York to Buffalo, as a tribute to New York soldiers who died in the World War. Announcement of the plan was made recently by Herbert S. Sisson, Highway Commissioner, after a conference with Clifford R. Pettis, State Forestry Superintendent, and members of the faculty of Syracuse University.

The trees for the first ten miles will be furnished by the College of Forestry, Syracuse University. If the experiment proves successful the Highway Commissioner hopes that the work will be continued.

CANADA HAS 470,000 AUTOMOBILES

Automobiles in Canada today number 470,000, according to the latest government figures on the 1922 registration of cars. The number of automobiles in the Dominion has nearly doubled in the last four years.

Canada ranks third among the nations of the world in the number of cars in use, being exceeded by the United States and the United Kingdom. The country ranking next to Canada in motor vehicle registration is France, with 236,148 cars. The next in order is Argentina, with 70,000, a total about equal to the registration in the province of Saskatchewan. Canada ranks second to the United States in the proportion of cars to population, with one car to every eighteen persons.

MICHIGAN ROAD CONTRACTORS FORM NEW ASSOCIATION

Michigan road and bridge builders recently met and organized the Michigan Road Contractors Association.

The officers are: President, L. D. Townsend, Lansing; William H. Ryan, Jackson, vice-president; C. A. Handyside, Detroit, treasurer.

The association will lend its energies to encouraging and promoting public highway improvement and harmonizing the interests of the contractor, the public, and public departments. The headquarters of the association have been established in the Capital National Bank Building, Lansing, Mich.

SOUTH CAROLINA COLLECTS $80,581 IN GASOLINE TAX IN ONE MONTH

January collections from the two cents a gallon tax on gasoline which is levied in South Carolina amounted to $80,581.94 according to figures furnished by the South Carolina Tax Commission.

The amount collected for the preceding ten months, commencing with March, was announced to be $767,032.65, making $847,614.59, the total amount for the eleven months in which the tax has been imposed.

According to the act one-half of this amount was credited to the general fund, to be used for defraying the ordinary expenses of the state government, and the remaining half was distributed to the counties to be used exclusively for the construction or maintenance of roads.

The distribution among the counties is in such manner that the amount received by each county bears the same ratio to the total amount distributed as the amount of the assessed value of property in such county bears to the total amount of the assessed value of the property in the entire State.

INDIANA PROGRAM SPENDS OVER $1,600,000 FOR HIGHWAY BRIDGES IN THREE YEARS

Some idea of the immensity of work connected with Indiana's program for a splendid state roads system is gleaned from a recent report of William J. Titus, chief bridge engineer, that in three and one-half years' existence the state highway commission contracted for 148 bridges at a total contract price of $1,621,057.41.

These bridges have a total clear span of 2.52 miles in addition to the length of the piers, abutments and wing wals. In other words if all bridges contracted for by the commission were in one huge structure it would reach two and one-half miles.

Mr. Titus points out that federal aid was received on 81 bridges—meaning that Indiana paid only half the cost of construction. In fact federal aid was obtained on structures costing $908,945.14, the report says. There was no federal aid on 65 structures costing $425,601.34, because of their isolation from approved federal aid projects, but whose construction was necessary in order to keep the state road system open to continuous traffific. Two of the total 148 bridges were county aid projects costing $286,510.94. They were constructed under state highway supervision.

The report shows that in 1922 the commission had under construction 55 federal aid bridges, 58 state aid and one county aid project, making a total of 114 structures with a total cash disbursement of $555,099.42. Twenty-two of the federal aid projects and 38 state aid bridges were contracted during the year at a total price of $585,624.93. Thirty-four federal aid, thirty state aid and one county aid projects were completed in 1922 at a total cost of $827,462.71. The value of all work done during the fiscal year, including the re-

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FOUR NEW HIGHWAY BRIDGES PLANNED FOR MISSOURI RIVER

For many years Missouri has lacked adequate facilities for highway crossings of the Missouri River. This has been a serious impediment to commercial and social intercourse between the two sections of the state. However, this unsatisfactory condition is about to be remedied by four projected bridges to be constructed at Boonville, Glasgow, Wavenly and Lexington. All are now under contract and the substructure work of the Boonville bridge is well under way. All are high level bridges with sufficient clearance above standard high water to render unnecessary any type of movable spans.

The Boonville bridge will have a steel superstructure 2,665 ft. long and a substructure of concrete piers resting upon bed rock, the lowest elevation of which is 84 ft. below standard low water. A clear roadway of 18 ft. 8 ins. is provided. The estimated cost of this structure is $526,640.

The Glasgow bridge consists of four gow end is nearly 300 ft. long and is composed of three deck spans. An earth river spans, approximately 1,224 ft. total length. The approach at the Glas- fill 225 ft. long connects the approach with the city. For the west approach, four deck spans totaling 384 ft. are provided. The river piers rest upon bed rock about 38 ft. below standard low water at the deepest place. A clear roadway of 21 ft. is provided. The contract price for this structure is $566,312.50.

The bridge at Waverly consists of five river spans, having a combined length of nearly 1,610 ft. Piers are sunk to bed rock about 53 ft. below standard low water. The approach at the Waverly end is made up of one deck truss span and two deck girder spans having a total length of 345 ft. A roadway of 20 ft. between wheel guards is provided. The contract price is $585,146.32.

The Lexington bridge has a steel superstructure 3,071 ft. in length. Bed rock is approximately 100 ft. below low water. On the Ray County side, an earth fill connects the main structure with the mainland. On the Lexington side the main structure is connected by a steel trestle with the city streets. A roadway 20 ft. in the clear is provided. Contract price is $1,169,114.10.

tained 10 per cent. was $566,701.84, compared with $559,359.06 in 1921 and $78,063 in 1920. All the contracts awarded last year were completed except the Reelesville bridge, and practically all awarded during the spring and summer of this year, competed, Mr. Titus says.

All bridges constructed by the state highway commission have a minimum 20-foot roadway and are designed for 20-ton traffic. Many larger ones have a 5-foot sidewalk on either side of the drive and ornamental lighting system. In numerous instances if a bridge is near the corporate limits, city or town cooperates and pays a portion of the extra cost for such additional improvements.

NEW YORK STATE SPENDS $16,328,000 HIGHWAY CONSTRUCTION DURING 1922

The following figures, which set forth the present status of New York state highway construction, were presented by John H. Gordon, president of the New York State Roadbuilders' Association at its annual banquet held recently in Albany.

Work completed in 1922 that was awarded in:

1919	$352,000
1920	301,000
1921	8,561,000
1921 (repairs)	1,653,000
1922	4,697,000
1923 (repairs)	764,000
Total completed during 1922	$16,328,000

On Jan. 1, 1923, there remained to be completed, work awarded in:

1919	$40,000
1921	1,787,000
1922	11,645,000
1922 (repairs)	2,020,000
Total remaining to be done, as of Jan. 1, 1923	$15,492,000
Construction contracts award- 1922	$16,470,000
Repair contracts awarded 1922	2,784,000
	$19,254,000

Of the construction awarded in 1922, $129,000 was cancelled.

Appropriations for work to be let during 1923:

Construction	$18,000,000
Repairs	9,988,000
	$27, 988,000

A summary of conditions now and a year ago shows the following:

Work done in 1921	$25,105,000
Work done in 1922	16,329,000
Excess of work done in 1921	$8,776,000
Work left over from 1922	15,492,000
Work left over from 1921	12,633,000
Excess of work left over from 1922	$2,859,000

ENGINEERING FORCE OF CALIFORNIA HIGHWAY DEPARTMENT IS REDUCED

The newly appointed California State Highway Commission recently announced that material reductions will be made in the number of employees in the engineering department.

This is not to be taken as an indication of decrease in efficiency, it is stated, as the men to be released are chiefly the engineers and draftsmen working on proposed extensions of the highway system which the new commission does not expect to undertake now.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES.
1923 EDITION

The S. E. Hendricks Co., Inc., 70 Fifth Avenue, New York City, has recently issued the new 1923 edition of its Register. It contains 150 pages over and above the 1922 edition. The lists completely cover the electrical, engineering, machinery, building, manufacturing, chemical and other industries, together with all industries allied thereto. The lists are for the use of both buyers and sellers.

Over 18,000 products are separately classified with the name and address following of every manufacturer or producer, together with the trade name or brand and also essential facts regarding the products of many of the leading firms. These classifications are made of very easy reference by an admirable system of indexing and cross-indexing.

Hendricks' Commercial Register is a widely known and used annual publication which has now reached its 31st annual issue. It is known as "The Original Register."

During the Register's 31 years of publication, purchasing agents, sales managers and others interested in the buying and selling of the products which the Register covers have found the work to be an invaluable adjunct to their business. Its use is nation-wide.

GOOD ROADS TO BE FEATURE OF ATLANTIC CITY "HOME AND CITY BEAUTIFUL" EXPOSITION

An exposition of twelve weeks' duration, during Atlantic City's great summer season, will be conducted on the Million Dollar Pier for the purpose of promoting the great Home and City Beautiful Movement. The exposition will open June 16th,a nd continue until September 8th, 1923. Al of the exhibit floor space of the Million Dollar Pier, America's finest and largest exhibition structure, in excess of 100,000 sq. ft., has been engaged for this exhibit.

Leading industrial concerns are taking keen interest in the coming exposition because the project is in line with modern methods top romote industrial progress of the nation and it is generally recognized that there is no better place than Atlantic City for an exposition of this nature for reaching all classes with whom they seek to transact business and in greater numbers, invluding the consuming public, buyers and merchants, than can be reached anywhere else or byo ther methods at the same extremely moderate cost.

American manufacturers and distributors of products for extensive distribution, who are offered an opportunity to participate in the exhibits, include the following main groups: Public and private buildings, materials, equipments and furnishings; the City Beautiful, embracing municipal improvements, hygiene, sanitation, fire and accident prevention; pure food products, confections and beverages; the Garden, seeds, supplies and horticultural accessories; art, sculpture and ornaments; musical instruments adn reproducers; recreation, athletics, travel information, and a section for radio; also one for toys and playthings for kiddies and the grownups.

To show contrast in modern and ancient civilization the exposition management will erect and completely furnish a modern "Home Beautiful," and will also reproduce a "House of the Ancients," as an example of a contemporary type of residence in vogue in the days of the Egyptian Pharaoh Tut-Ankh-Amen.

Management of the exposition is in the hands of A. Conrad Ekholm, exposition manager, former President of the Avenue Hotel Association of Atlantic City, and director of many expositions in the resort. It is under the auspices of the American Home and City Beautiful Association, with the two-fold object of encouraging the use of products of American manufacture and education of the public in home and city beautification.

MINNESOTA HAS 82,660 MILES OF IMPROVED ROADS

Minnesota now has 82,660 miles of improved road not including that added during last season, according to the U. S. Bureau of Public Roads, which has made a complete census int he State. The improved mileage at the beginning of 1922 was as follows:

Graded andd rained	65,755
Sand-clay	3,975
Gravel, chert, and shale	12,188
Water-bound macadam	169
Surface treated macadam	75
Bituminous macadam	19
Sheet asphalt	9
Bituminous concrete	100
Cement concrete	350
Brick	10
Wood block	10

The total road mileage of the State is 107,103 miles, as compared with 93,517 miles in 1914, and during the seven-year period from 1914 the graded and drained mileage has increased from 15,378 to 65,755 and the surfaced and paved roads from 3,968 to 16,904 miles.

The total revenle in 1921 amounted to $40,357,925, or $499 for aech square mile of area, $377 for each mile of road, or $16.91 per capita.

Personal Mention

George C. Brown has recently been promoted from the position of resident engineer with the Michigan State Highway Department to that of district engineer in charge of maintenaance, with headquarters at Ann Arbor.

D. G. Scott, of Henderson Harbor, N. Y., has been appointed by the board of supervisors of Jefferson County, N. Y., as county superintendent of highways.

Frank R. Goodman, state engineer of Arizona, announces the selection of his staff as follows: Assistant engineer, W. W. Lane; district engineers, northern, B. M. Atwood, eastern, W. R. Hutchins, central, Clyde L. Jenkin, southern, Edward Ten Eyck; superintendent of equipment, P. J. Harrison.

John R. Caldwell of Madison, Wis., has been appointed county highway commissioner of Dane county, Wis., to succeed Edward J. Smith, resigned.

INDIANA ASKS PUBLIC TO COOPERATE IN SPRING MAINTENANCE PROGRAM

An appeal has been made by the state highway officials of Indiana that personsu sing the roads for heavy traffic during thaw periods exercise judgment in order to protect gravel and stone roads at a time when they are destined to cut and rut most owing to conditions beyond human control.

A. H. Hinkle, superintendent of maintenance, sent a bulletin to all district engineers advising that he expected them personally to see that the public using the roads undert heir particular jurisdiction, refrain from wilfully damaging highways by reason of hauling extremely heavy loads when the roads were soft.

Not all of the frost is out of the ground, Mr. Hinkle explained, but the moderate temperature of the last few days has left the surface of gravel and stone roads soft and in acondition readily cut under the wheels of heavily loaded vehicles. He called specific attention that log haulers and others hauling heavy freight can well afford to cease their activities for a short period ino rder that roads can be put in condition at an earlier date for traffic. Heavy traffic using asoft road one week during the softest period may prevent use of the road for heavy loads for three or four weeks thereafter, he said.

He also called attention to the Indiana law which says it shall be unlawful for any person to haul over any turnpike, macadam, or gravel road (the term "gravel road" to include any road graded to 8 ft. in width and 9 ft. in length of such road), at any time when the road is thawing through or by reason of wet weather is in condition to be cut up and injured by heavy hauling, a load on any vehicle witht ires of less than 3 in. in width, the combined weight of which load and vehicle, including driver, shall be more than 3,000 lb.;o r any vehicle with tires of 4 in. and les than 5 in. in width, the combined weight of vehicle, olad and driver, shall be more than 3500 lb.; or any with tires 5 in. or over in width, the combined weighto fw hich is 3800 lb. Any person violating any provision of this section shall, upon convicition, be fined not less than $5 nor more than $50 for each load so hauled.

Mr. Hinkle told district engineers and superintendents that he expects them to watch out for offenders and help in every way possible to enforce this law. He declares that if proper judgment is exercised by the public at thit critical time of the year, it will result in saving thousands of dollars in maintenance of state roads.

ISLIP, L. I., BUYS OIL SPREADER

The Town of Islip, L. I. has purchased an 800-gallon Champion oil distributor costing $2,800, for use on the 300 miles of highway int he town. Superintendent of Highways Harwood plans to spend over $25,00 for oil on the Islip roads.

OFFICIAL PROPOSALS

STATE OF MARYLAND

STATE ROAD COMMISSION

Notice to Contractors

SEALED PROPOSALS for oiling 5 sections of State Highway, requiring approximately 576,127 gallons of oil, as follows:

Dist. No.	Counties	Miles	Gals.
1 & 2	Cecil, Queen Anne, Somerset, Talbot, Wicomico, Worcester	24.76	48,381
3	Montgomery and Prince George	35.10	66,145
5	Carroll, Frederick, Howard, Montgomery	111.01	213,976
6	Garrett, Allegany, Frederick, Washington	60.45	120,912
4 & 7	Anne Arundel, Baltimore, Harford	57.35	126,713
		288.67	576,127

will be received by the State Roads Commission, as its offices, 601 Garrett Building, Baltimore, Maryland, until 12 M. on the 6th day of March, 1923, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans will be furnished by the Commission upon application.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred ($500) Dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

BY ORDER of the State Roads Commission this 21st day of February, 1923.

JOHN N. MACKALL,
Chairman.

L. H. STEUART, Secretary.

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- 1 Austin, 10 ton, crane, mounted on caterpillar traction, and driven by Buffalo Gasoline engine, 40 ft. boom.
- 1 8½ D. D. Acme crusher, 12x16, elevator, screen, portable bin and 20 H. P. gasoline engine.
- 1 Haiss wagon loader, gasoline driven.
- 1 Erie, type "B" combination crane and shovel.
- 2 75 H. P. locomotive type boilers, on skids.
- 1 100 H. P. locomotive type boilers on skids.
- 1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
- 1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.
- 1 7x10 Lidgerwood DC DD hoist and boiler.
- 1 7x10 Lambert DC DD skeleton hoist.
- 24,000 ft. Lakewood 24 in. ga. 20 lb. portable track, 15 ft. sections, with turnouts complete.
- 50 Batch box cars and 30 cu. ft. batch boxes.
- 4 6 ton, 24 in. ga. Whitcomb locomotives.
- 4 6 ton, 24 in. ga Cummings locomotives.
- 2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
- 2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.
- 1 Foote Paver, Shop No. 1484, self-propelling, steam driven, 2-bag batch; overhauled ready for work.
- 1 14-E Rex Paver, caterpillar traction.
- 1 No. 11 Koehring Paver, wheel traction.
- 3 Lakewood sub-graders.
- 1 7 ton guy derrick, 70 ft. boom.
- 1 7 ton stiff leg derrick, 60 ft. boom.
- 5 Lakewood finishing machines, 16 ft., 18 ft. and 20 ft.
- 1 10 ton Buffalo-Pitts steam roller.
- 1 10 ton Austin gasoline road roller.
- 1 Derrick car, 8 wheel, M. C. B.

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GOOD ROADS

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WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIV MARCH 7, 1923 No. 10

Minnesota Highways

How They Are Being Developed Under the Babcock Good Roads Plan

MINNESOTA has completed nearly 5000 miles of grading, gravel-surfacing and paving improvement, re-shaped nearly 1000 miles and re-surfaced more than 800 miles, on its 7000-mile system of state trunk highways under the Babcock Good Roads Plan. This plan has been in full operation eighteen months.

Grading, graveling and paving betterments on these roads when taken over by the state from the counties measured less than 4000 miles, compared to the present 9000-mile total, and represented accomplishments by the couties remaining after more than fifty years of work on them. Results achieved in a brief period are making the Babcock Good Roads Plan internationally known and directing scores of inquiries to the Minnesota Highway Department. Many questions relating to the plan and program are answered in the following statement authorized by the department:

Road Mileages Divided

Minnesota has approximately 100,000 miles of public roads. The most important, known as Trunk Highways or "Babcock Roads" and estimated to carry four-fifths of highway traffic in the state—averaging 710 vehicles a day in 1922—make a 7000-mile network serving all sections of North Star state. Next are the so-called State Aid roads, in charge of county road authorities but sharing in apportionments of state highway aid, and totalling some 8500 miles. County and township roads under local control make up the remainder of the Minnesota public highway system.

For more than half a century, road improvement and maintenance in Minnesota was entirely in charge of local road officials. Entrance of the state into highway improvement came in 1905 with the adoption of the Robert C. Dunn amendment to the state constitution. This provided for a general tax levy of one-twentieth of a mill for state highway aid and was followed by creation of the state highway commission. The state aid plan was based upon the principle that the wealthier counties of the state should assist in financing road betterments in the counties with comparatively smaller assessed valuations. The tax rate was raised from time to time—and now is one mill, yielding more than $2,000,000 annually. Laws fix limits of one and three per cent on the minimum apportionments to the various counties.

Babcock Plan Presented

The Minnesota highway commission was largely an advisory body, supertintending road construction on which state aid was used and assisting county highway engineers with the more difficult and important construction problems. Under George W. Cooley, now deceased, as highway engineer, it fostered public interest in more adequate highways. After several years, friends of the good roads movement in Minnesota brought about substitution of the commission plan with that of a single commissioner. Charles M. Babcock, a member of the commission who had taken special interest in it, was named single commissioner.

Commissioner Babcock foresaw rapid development of the automotive industry and the demand for more adequate highways that would result. He adopted the theory that wheels using the roads should pay toward road improvement and upkeep, believing as has since been demonstrated, that the automobile and truck owner can better afford to pay reasonable taxes for better highways than to bear heavy expense for car upkeep, gasoline and tires. Upon this he built up the good roads development plan bearing his name.

Convinced that intercounty roads carrying traffic from one distant point to another should be under state control, just as intertownship roads were and are under county control, he proposed a state system of trunk highways. A special method of financing operations on this proposal system was offered through a more onerous tax upon motor vehicles, in lieu of all other save city and village wheelage levies, and with a bonding feature. Work required on the main or primary roads in the state always had taken a large portion of available road funds. The new plan, it was pointed out, would re-

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lieve counties of this burden of expense and leave them the usual funds intact for use exclusively on the local roads.

The Babcock Good Roads plan was submitted to a vote of the people in Good Roads Amendment No. 1 at the election of 1920 and received affirmative votes in five out of seven ratio. Its adoption followed a vigorous campaign directly by a semi-public corporation of good roads advocates, known as the Minnesota Highway Improvement Association.

MINNESOTA TRUNK HIGHWAY NO. 2
This road between Crossby and Deerwood serves thousands of tourists in the states summer playground.

Predictions were made that counties might anticipate transfer of primary highway to the state and abandon their improvement and upkeep, and the Legislature of 1919 authorized boards of county commissioners under certain restrictions to issue up to $250.000 each of bonds, the proceeds to be used on the proposed trunk routes under an implied understanding that each county would be reimbursed in the event of adoption of Amendment No. 1. Many counties acted under this authorization and approximately $15,000,000 of reimbursement bnods were voted by the counties collectively. The funds were used on the trunk highways by the counties under the supervision of the state department.

Amendment No. 1 enabled the Legislature to authorize issues of state trunk highway bonds, not to exceed $10,000,000 in any single year and the amount outstanding not to exceed $75,000,000 at any one time. It also left to the Legislature all details of administration.

Although no trunk highway bonds were authorized, the Legislatuhe of 1921 passed laws to put into operation the new departure of direct building and maintenance of primary highways by the state. After extended study and investigation the plan of single commissioner administration was continued in the highway department.

Auto Taxes Scheduled

The new lieu tax on motor vehicles was fixed at 2 per cent. of the factory list price of the automobile or truck, with discounts for depreciation of 25 per cent. on cars over three and 50 per cent. on those more than five years old, and tax minimums of $12 on passenger cars and $15 on trucks. Motor vehicles for public hire were taxed an additional 25 per cent. Unexpected reductions in factory list prices resulted in inequalities in motor vehicle taxation and the scheduel probably will be revised by the Legislature of 1923 meeting early in January. There is sentiment for basing a portion of the motor vehicle tax on the gasoline consumption of the machine, as an equalizer of taxes on light and heavy vehicles and those using the highways for greater or less mileage of travel, and to allow tourists from other states to contribute to the cost of roads used in Minnesota. Sentiment also favors increases in taxes on motor trucks and busses for hire.

In connection with the commonly called "gasoline tax," Minnesota friends of good roads point out that an extra tax of 2 cents a gallon would cost the average car owner not to exceed $8 a year and give him in return the big savings possible from $2,500,000 of better roads annually.

New Organizaion Speeded

No laws effective late in April, 1920, Commissioner Babcock at once began activities under the new order of things. The start was virtually from the zero mark, save for the small organization nucleus represented by the previous highway department. John H. Mullen, chief highway engineer who through long service in the old highway department had gained a comprehensive knowledged of Minnesota road conditions and needs, was made assistant commissioner and continued as chief highway engineer, and J. T. Ellion, also continued in his capacity of chief bridge engineer, was given the other assistant commissionership. Highway builders with technical training and wide experience were chosen engineers in eight divisions and superintendents of maintenance in sixteen districts covering the entire state.

A force of about 1000 trunk route patrolmen was recruited within 60 days and put to work, one to drag and keep smooth each 5-mile average section on the 7000-mile system. Also, maintenance gangs equipped with tractors and trucks and covering longer sections were put in the field. They helped patrolmen in some sections to shape conditions for most effective maintenance.

This provision started to insure the best possible conditions on existing roads, Commissioner Babcock's next step was to build up poor stretches in long mileages of otherwie good roads—an application of the saying that a chain is no stronger than its weakest link. The policy was aimed to put the entire 700 miles of trunk highways in fairly passable condition before any betterments were started even on the routes serving the largest numbers of highway users. Incidentally, department headquarters wer emoved to a new building in St. Paul obtained at greatly reduced rental rate.

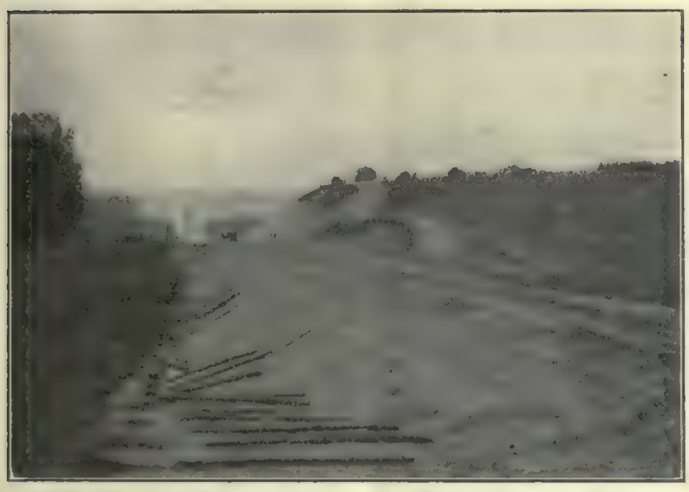
"YESTERDAY ROADS" ARE RAPIDLY DISAPPEARING IN MINNESOTA.

Operations were gauged to fit available funds. Motor vehicle taxes—averaging $16.75—were estimated to yield $5,500,000 and the government had furnished about $1,-

415,000 of federal highway aid, making a total of $6,015,000 current trunk highway funds for 1921. The Babcock plan placed a reasonable total at $10,000,000 a year, and while current revenues fell far short of this figure, it was in fair proportion to the season which had advanced during delays in enacting necessary legislation. Approximately $2,500,000 was set aside for maintenance oerations, and more than $4,400,000 was left for construction purposes—permanent betterments in addition to those resulting under systematic maintenance. Further, balances from sales of county reimbursement bonds under the 1919 law were employed to make permanent improvements in the respective counties issuing the bonds.

New Construction Pushed

During July, 1921, more than $5,000,000 of new construction on Minnesota trunk highways was under way—the spreading of permanent benefits from the new plan on primary roads had begun in earnest. Other contracts were awarded later. A serious winter unemployment situation loomink in the fall of 1921, Commissioner Babcock laid plans for an emergency relief progtam of winter operations on the highways. As a member of President Hardngi's conference on unemployment, he urged provision especially through federal aid to continue highway building, notably gravel surfacing durink winter months. He maintained that such work could be carried on advantageously and economically in Minnesota and therefore that states to the south, east and west could do likewise. Congress made the federal highway aid available without unnecessary delay and Minnesota put through an extensive winter program which gave work to thousands, including many needy farmers, and also speeded needed road betterments.


THE DEEPEST OPEN HIGHWAY CUT IN THE UNITED STATES
This view just south of Minneapolis, on Trunk Highway No. 50, shows how Minnesota is building grades straight and level. The cut shown is 65 ft. deep and 250 ft. across, and is the deepest in the United States.

In 1922, to date current trunk route funds available compared favorably with those of 1921. Decrease in net reimbursement bond money used was to some extent offset by increase of motor vehicle tax revenues to nearly $6,500,000 and $1,420,000 of federal aid was credited again. Regular maintenance was kept up on the lines first inaugurated and money was put on the roads as fast as it became available. All funds, of course, were disbursed on verified vouchers through the state auditor's office and state treasury. In Table 1 are the 1921 tabulations showing the sources of the average Minnesota highway dollar, and the uses to which it was put on state trunk highway construction and maintenance.

Local road expenditiures by the highway authorities in 66 counties and much larger numbers of townships and cities and villages are not tabulated for the whole state.

Keen competition brought comparatively low prices on all classe of highway construction. Although 1922 averages are not compiled at this time, they are expected t oshow decreases over the 1921 costs. The latter showed averages, with all items included, of $5610 a mile for grading, $3383 for gravel-surfacing and $35,520 for paving, mainly of concrete, 7½ in. thick and 18 ft. wide. These prices were considerably lower than those previously paid by counties for similar work and furnished a strong argument for state construction of more important highway improvements.

TABLE 1. THE MINNESOTA HIGHW AY DOLLAR

For Trunk Highways, 37 Cents—	Reim. Bonds..	$ .12
	Auto Taxes...	.17
	Federal Aid...	.08
For Local Roads, 63 Cents—	County Taxes.	.325
	Towns'p Taxes	.205
	City-Vil. Taxes	.04
	State Aid.....	.06
Totals	$1.00	$1.00

Trunk Construction.		Trunk Maintenance.	
Grading	$ .40	Patrol	$ .445
Paving	.265	Repairs	.28
Graveling	.17	Beterments, etc.......	.21
Bridges	.065	Administration	.05
Culverts	.04	Special Work	.015
Clearing	.02		
Tiling	.02		
Miscellaneous	.02		
	$1.00		$1.00

Progress under the Babcock Good Roads plan in Minnesota is shown on a summary of improvements contracted and nearly all completed during the first eighteen months. (Table 2.)

TABLE 2. STATE RECORD ON TRUNK ROUTES
(During first 18 months)

Miles	At Start*	By State	Totals
Graded	1,499	2,261	3,760
Graveled	1,371	2,246	3,617
Paved	112	241	363

*Mileage listed as improved by counties when trunk routes were taken over by the State.

Foregoing progress totals are exclusive of 982 miles of reshaping and 804 miles of resurfacing by maintenance forces which spread early benefits of the new plan to every part of the system.

Benefits Spread Wide

Effects of Minnesota's new highway plan were far-reaching. Marked improvement in conditions over the 7,000 mile trunk highway system was a matter of public comment and was credited with setting higher sandards of improvement and upkeep on local roads. Relieved of the expense of main highway improvement and maintenance which formerly took a large share of local funds, counties, townships and cities and villages were able t oobtain better road resuls. Local tax levies for road and bridge purposes which had increased steadily to more than $21,000,000 a year, were reduced for

(*Continued on page* 93)

Heavy Truck Hauling in Highway Construction

A Discussion of the Factor Essential to Successful Operation

By CHARLES H. FRY

President, Chas. H. Fry Construction Company

THE title of this paper implies a certain amount of foregone conclusion in regard to preference for heavy duty trucks for haulage purposes in connection with highway construction, particulary when presented by an author whose experience has led him into favoritism for this type of hauling equipment. Notwithstanding, this paper is presented with a full understanding that experienced and well informed minds often differ on the subject of methods.

Irregardless of the methods employed, several standard methods having gained preference among various highway constructors in various sections of the country, we are, however, allowed to assume that the road constructors and the equipment manufacturers and distributors are all determined upon one definite objective i. e., production progress with the least necessitated amount of waste, i. e., waste capital (investment) waste labor, waste material, waste efficiency, waste what not. In the last analysis, we aim for the minimum cost per unit of laid concrete, excavated or filled earth or rock.

The proposition which concerns the members of this audience, in their everyday experience with the trade, is what method attains the common objective and proves itself superior over all other methods? This is a question not easily answered. Therefore, the author desires to draw attention to those determining factors, which, in his estimation have governed his management in the selection of the heavy duty truck for haulage. The author confines himself to a discussion of haulage equipment serving in the construction of macadam, gravel, "stone," and concrete roads.

Determining Factors

The natural sand-gravel roads such as abound on and near those flat plateaus surrounding and adjacent to the Great Lakes, as well as similar natural roads found in other sections of our country, also the rock formation forming the sub-base for so many of the roads in the mountainous districts of the United States, without a doubt, serve best for permitting the utilization of the heavy duty truck. This type of sub-base permits the early escape of heavy duty trucks at times when saturated clay and muddy roads would necessitate costly loss of time from continuous operation. Such a factor has contributed toward making the author a heavy duty truck enthusiast when possibly a highway contractor in some other section of the country would favor a different method.

One point to consider in this connection is—in how large an area of our country can the heavy truck be utilized to distinctive advantage? The factors to be considered in this paper point the way to a comprehensive survey. Recent charts compiled and edited by the Associated General Contractors of America, showing the seasons of the year suitably and practically adapted and in force for road construction purposes in the various states of the Union, will serve as a guide in reaching a conclusion.

Closely related to the foregoing and hardly less important is the subject of hauls. Obviously the only ones to be considered are short and long hauls. Other things being eqaul, the advantage is constantly growing in favor of heavy duty trucks because of the increasing tendency toward longer hauls on contracts being let by state highway departments.

The long haul utilizing heavy trucks reduces the amount of field supervision such as is necessitated when fleets of small trucks are on the road. One striking advantage in operating fewer units is the obvious absence of contributing causes toward units getting in the way of one another. Simple though it may seem, this is a very important consideration in the hills and in the mountainous country removed from the Lake Region and the flat country of the Middle West. The long haul manifests the advisability of heavy units, particularly when taking into consideration the availability of experienced and dependable labor.

Co-ordination

We cannot intelligently discuss haulage characteristics and requirements without taking fully under advisement the correlated equipment and special appliances which are utilized in the other operations. Like all industries, which, in their pioneer days, were hampered and delayed from time to time because of inadequate facilities and lack of improved equipment, so was the road construction industry handicapped in its early days. Of late years, however, the road construction industry has been the beneficiary of many improved types of equipment, so that instead of becoming impoverished because of neglect or indifference, we find ourselves today reinforced along every avenue of exertion by improved and, in numerous instances, highly developed and patented road building appliances. These have been devised to ameliorate the obstacles long contended with.

The equipment manufacturers have proven themselves practical students of a stupendous industry as is testified to by the numerous dependable types of labor saving road construction equipment now on the market. We have both ends of the haul to consider, not ignoring the requirements that demand attention between the two extreme points of operation. Between the measuring and striking off points and the unloading point at the paver skip, the heavy duty truck stands as a supreme testimony of efficiency. As the old adage goes—"An early start is half the race."

Gliding into position under an improved and latest design measuring and striking off hopper, a heavy duty truck stops for the fractional part of a minute, swallows its load of four standard six bag batches of aggregate and is off on the last leg of the journey in no more time than is required to do the same thing with one batch only on a light truck. And when the big truck arrives at its destination, backing into the paver, the fewer the trucks, the lesser the disturbance along the way and at the paver itself.

Without entering into an analysis of pure cost data or summarizing along this particular vein, there are

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Paper presented before the annual convention of the American Road Builders Association, Chicago, Ill., Jan. 15—19, 1923.

outstanding merits in favor of heavy trucks along lines of pure operation and maintenance. The restricted labor supply of the past warrants the conclusion, comparatively speaking, that a few dependable and seasoned truck drivers of known qualifications form an operating force far superior to a larger force of doubtful personnel. The trained driver on the big truck, educated to maintain his unit and to take pride in its performance is an asset to your organization and a factor to be considered in getting the efficient drivers and maintenance men, and they are ordinarily few, particularly when labor is at a premium.

In this connection, it is known that heavy trucks are slower than light trucks, nevertheless, there is apparently an advantage in wear and tear. It appears that the heavy truck stands the vicissitudes of operation to more marked advantage—the ruddy frames, the heavy wheels, the big tires, the staunch bodies, as well as the enlarged members of motor, driving and transmission machinery, the ability to take punishment, seem to stand the gaff and are readily amenable to satisfactory overhaul. The great, strong, dependable units take their place admirably in helping to weave the cloth of progress.

Flexibility

When the contractor finds himself in the market for the purchase of transportation equipment, without a doubt, he finds himself dealing with the most complex problem of road building. To arrive at any decision he must consider so many details that in the end he generally feels that he has reached only the experimental stage. There is a constant and inviting incentive to attain the best results. In touching some of the major problems consider first the investment. The expenditure for any type of hauling equipment is the largest item of the contractors plant. This fact alone should cause the contractor to choose the most flexible equipment.

In the selection of motor haul equipment the road constructor must be governed by the various requirements which will manifest themselves from time to time during the progress of his management. When he considers that he will be forced from time to time into competitive bidding upon all kinds of road contracts presenting multifarious conditions, the contractor, of necessity, must plan upon a suitable degree of flexibility. Heavy duty trucks provide for this flexibility that cannot always be provided for under other methods.

Heavy trucks provide general adaptability. Even in seemingly unimportant ways, they are adaptable. In storage alone they require less space during lay up and during idle time. Innumerable times they serve to manifest an indisputable advantage in towing other types of equipment. They augment the facility with which the general equipment is moved on and off the job. In the matter of grades, experience has proven that the heavy unit will pull up and take any grade that the light unit can negotiate.

In the matter of sub-base, the greatest argument against heavy trucks seems to have been accusation that the sub-base was subject to an excessive amount of cutting up; but experience substantiates the contention that when sub-base conditions are at all favorable, the big trucks with their wide tires iron out the sub-base and pack it down like a roller. From the standpoint of public interest this provides a more substantial job.

In summarizing the elements of this paper, the author has endeavored to point out the main factors which through analysis have placed him in the position of a heavy truck enthusiast. He has been favored with the privilege and opportunity to operate and study different haulage methods, more or less of the time, of course, in a locality and at seasons of the year well adapted for the utilization of heavy units. And he has no argument with other contractors who may have a cherished method altogether different which may be entirely laudable and entirely adequate for the conditions encountered.

MINNESOTA HIGHWAYS

(*Continued from page 91*)

the first time in state annals to nearly $19,000,000 in 1922, the first levy after inauguration of the Babcock plan.

Automobile and truck owners pay but little more taxes on their machines than under the personal property levies and thousands assert they are making more than the amounts of their taxes in savings on car repairs, gasoline and tires—merely diverting to better roads money that otherwise would have been spent for automobiles and accessories.

Advancement of the Minnesota trunk highway program will depend largely upon financial provisions to be made by the Legislature of 1923. Commissioner Babcock will recommend first issues of trunk highway bonds, also an act to enable counties which authorized no reimbursement bonds under the 1919 statute to do so and overcome the handicap now enjoyed by others, and many minor amendments to the highway laws. More liberal provision of funds must be made, he points out, if Minnesota is to maintain its reputation as a leader in good roads, now that other states through large bond issues and otherwie are expending vast sums for highway betterments.

A View Along Trunk Highway No. 20.

Minnesota Road Building involves all kinds of earth conditions as well as climatic extremes. This road near the village of Lanesboro was built with the same type of equipment as was used to construct railroad lines across the Rocky Mountains.

Reasonable funds provided, highway officials assert, 1923, and 1924 will be years of even greater improvements noticeable on Minnesota trunk routes because the highway department will be able to furnish many miles of costly grading which took nearly half of the construction funds to date besides putting through many other improvements.

Current Events in the Field of Highway Engineering and Transport

ILLINOIS ADOPTS NEW DESIGN FOR CONCRETE PAVEMENTS

Illinois State Highway Department Will Save Nearly 200 Cubic Yards of Concrete per Mile

As a result of the tests made on the Bates Experimental road, recently completed, a new cross-section design for concrete pavements has been made standard by the Illinois State Highway department. This new cross-section provides for a thickness of 9 in. at the edges of the pavement tapering to 6 in. at a distance of 2 ft. from the edges. The remainder of the pavement is to have a uniform thickness of 6 in. and the amount and arrangement of reinforcement are to be the same as that hitherto used with the exception of the center-joint material. A new design has been provided for the center joint to correspond with the new six-inch center thickness.

The Bates tests show conclusively that the strength of the edges of any rigid pavement built according to the design hitherto used is much less than the strength of the interior portion of the slab. These tests disclosed the fact that a center thickness of 6 in. or perhaps even 5 in., is ample to support the legal load limit provided by the Illinois laws, and the new cross-section takes advantage of this fact. The tests further indicate that even with a 6 in. thickness for the main portion of the slab, a 7 in. edge with a ¾ in. longitudinal bar would still not be as strong as the center of the slab. For this reason the thickness of the edges has been increased.

The attention of contractors who expect to bid on Illinois road work is called to the fact that the new cross-section provides 1 sq. ft. less of cross sectional area than a slab having a 7 in. uniform thickness. This means that the new cross-section will require 195½ cu. yd. less of concrete per mile of pavement than the standard seven-inch design heretofore used.

WISCONSIN HIGHWAY DEPARTMENT WILL LAY STEEL RAILS IN CENTER OF CONCRETE ROAD BED

Wisconsin's Department of Highways will shortly make a unique and interesting experiment. A broad band of steel, from 10 to 15 in. across the face will be embedded in a cement road bed, flush with the surface of the road. These steel rails or bands will form a track for heavily loaded trucks and it should be easy for the driver to keep his wheels on the steel track, leaving it only when meeting another truck. Presumably the road will be wide enough to meet a passenger car or a light truck without turning out as the heavy truck will have the right of way.

There are a number of interesting angles to this experiment, but about the only serious question will be the effect the traffic will have upon the concrete, whether it will wear down in time and leave the steel bands higher than the surface of the road, though a slight incline on either side of the bands would have a tendency to overcome the objectionable features of the wearing away of the cement on either side of the rails. If the mixture is right a nominal repair expense will keep the road bed level.

Certainly the steel rail would bear a large percentage of the traffic and it is safe to assume that the track would equalize the burden of traffic and cause the road to last many years longer than the ordinary concrete highway.

If the experiment proves successful it is certain to be adopted by many other states. The result will be watched with interest by highway officials in all parts of the country.

HIGH COURT UPHOLDS MINNESOTA ROAD COMMISSIONER

Rules That Location of Highways Rests With State Highway Head—Not Courts

The commissioner of highways and not the district courts of Minnesota determine what land is necessary for right-of-way for trunk highways under the 1921 law, the supreme court held recently, reversing a decision of the Olmsted county district court.

Owners of land sought for a new location for Trunk Highway No. 7 just west of Byron secured an order in the district court dismissing the condemnation proceedings on the ground that the new route was unnecessary. The supreme court ruling in effect is that the highway commissioner is the designated judge of how the trunks shall be routed. The decision of the lower court was the subject of much discussion over the state.

ROAD CENSUS OF OREGON TAKEN

Oregon now has 23,608 miles of improved road not including that added during last season, according to the U. S. Bureau of Public Roads, which has made a complete census in the state. The improved road mileage at the beginning of 1922 was as follows:

Graded and drained	15,559
Gravel, chert, and shale	6,230
Water-bound macadam	840
Bituminous macadam	35
Bituminous concrete	746
Cement concrete	139
Miscellaneous	60

The total road mileage of the state is 45,475 miles, as compared with 36,819 miles in 1914, and during the seven-year period from 1914 the graded and drained mileage has increased from 4,719 to 15,559 and the surfaced and paved roads from 4,726 to 8,050 miles.

The total revenue in 1921 amounted to $28,532,824, or $298 for each square miles o farea, $627 for each mile of road, or $36.42 per capita.

1923 STATE HIGHWAY PROGRAM FOR NORTH DAKOTA

The State Highway Department of North Dakota is at present engaged in cleaning up the old work, correcting plans and quantities of 1922 construction season and in completing surveys and plans for Federal Aid Projects of the 1923 construction, which will involve (when the complete list of requests is in) approximately 450 miles of earth road construction and 160 miles of gravel surfacing to be placed upon projects completed in 1920-21 and 22. The 1923 construction will involve approximately 2,400,000 cu. yds. of earth excavation, 2,500 pipe culverts, 50 to 60 small concrete bridges, 21,000 cu. yds. gravel.

These projects will be advertised for bids during early spring at the county seat of the county in which the project is located.

CALIFORNIA ASKS $8,000,000 FOR NEW ROADS

Although the California State Highway Commission has called a halt, temporarily, in the awarding of highway contracts, the feeling of the State Legislatures on the road question is clearly expressed by the large number of highway appropriation bills introduced at the present session, says a recent issue of "Pacific Street and Road Builder."

Among the road bills introduced according to this journal the following are of exceptional interest:

By Mr. Crittenden, the appropriation of $2,000,000 for state highways in San Joaquin county.

By Mr. Williams, the appropriation of $670,000 for Yosemite Valley highway, from Briceburg to El Portal.

By Mr. Stevenot, the appropriation of $2,000,000 for Mother Lode highway, in Placer and Tuolumne counties.

By Senator Sharkey, the appropriation of $600,000 for a bridge across the San Joaquin river above Antioch.

By Mr. Davis, the appropriation of $350,000 for road, San Bernardino to Needles.

By Mr. Foster, the appropriation of $3000,000 for road, San Lucas to Coalinga.

By Mr. Johnston, $500,000 for a causeway one mile long from the American river bridge to the state highway in Sacramento county.

By Mr. Coombs, $100,000 for road, Hopland to Lakeport.

By Mr. Douglas, $225,000 for Klamath River bridge in Del Norte county.

By Mr. Bernard, $75,000 for state highway in Trinity, Tehama and Shasta counties.

By Mr. Coombs, $100,000 for highway, Middletown to Lower Lake.

By Mr. Clarke, $15,000 for highway from Bishop to State line.

SOUTH DAKOTA PLANS 400 MILES OF ROAD WORK

Approximately 400 miles of new state highway construction is included in the program of the South Dakota highway department for 1923. This work is to be scattered generally over the state. In addition to this new construction a large amount of the new construction of 1922 will be graveled. It is the policy of the department to gravel the roads a year after grading is done. Considerable bridge construction is planned for 1923.

IOWA STATE ENGINEER DENIES HIGHWAY WORK HAS MADE TAXES SOAR

Charges that have been made to the effect that increases in Iowa state taxes can be attributed directly to the increase in road making are false, according to Fred R. White, chief engineer of the state highway commission. The present need is not for a curtailment of the activities of the highway commission, but for a more comprehensive road building program for the state, he asserts. "Highway taxes constitute only 15 per cent of all taxes and they are responsible for but one-tenth of the increase which has been made in the state levy since 1919," he stated.

HAWAIIAN ISLANDS SEEK FEDERAL AID FOR GOOD ROADS

Efforts of the Hawaiian Islands to have the provisions of the Federal Aid Road Act extended to the territory of Hawaii are meeting with warm support from officials of the American Automobile Association and from some of its affiliated clubs. Raymond C. Brown, Secretary of State of Hawaii, is in Washington at present in the interests of obtaining Federal Aid for the Hawaiian roads.

"There is no doubt in my mind that the Hawaiian Islands are entitled to share in Federal Aid," said M. O. Eldridge, Executive Chairman of the American Automobile Association. "Hawaii is six times larger than Rhode Island, pays more internal revenue taxes into the Federal Treasury than any one of sixteen other states, her contribution being $21,000,000 a year, and owing to her United States, she is entitled to the proection of Uncle Sam and to share in all Federal Aid road appropriations made by Congress. In other words, Hawaii is an integral part of the United States and is entitled to anything that any other par of the United States is entitled o."

Secretary of State Brown pointed out that the value of Hawaiian imports annually is $56,000,000, while her exports amount to $72,000,000. Hawaii has a population of 250,000 and has expended on roads in the last ten years without any Federal help over $6,000,000. The improvement of roads in Hawaii, Mr. Brown points out, means increased production and increased revenue to the Federal Government, as well as better defense facilities for the Pacific Coast outpost of the United States.

The plan suggested at present, is to have a separate clause written and enacted into law, providing that the territory of Hawii shall hereafter be included under the provisions of the Federal Highway Act. It is felt that it will be better to handle the matter in this way than to attempt to amend the Federal Aid Act at this time.

URGE $75,000,000 HIGHWAY BOND ISSUE IN TENNESSEE

Sponsored by the Tennessee Good Roads Association, a movement is under way for the authorization of a $75,000,000 bond issue to complete the state highway system of Tennessee.

HIGHWAY WORKERS' PAY SHOULD BE RAISED DECLARES WISCONSIN ENGINEER

Adequate salaries must be paid highway workers if the best men are to be attracted to the road building industry, now in need of large forces of skilled employes, A. R. Hirst, highway engineer for Wisconsin, believes. The proper standards of pay for those employed in highway departments have not yet been reached, Mr. Hirst says. "The great difficulty in establishing a proper salary scale in the average state is that the whole scale of public salaries is too low," the state highway engineer said. "When the governor of a state receives a salary of $5,000 a year, it is hard to convince the people of the state that the head of any state department should receive more than the governor."

COLORADO TO PROVIDE SIGN POSTS FOR MAIN HIGHWAYS

Tourists who come to Colorado in the future will know where they are going. In the 1923 budget of the highway Department the sum of $70,000 has been set aside for the purpose of erecting markers on the main state highways and taking a traffic census next summer.

An arrangement has been made with the Mountain State Automobile Association, a Colorado organization, whereby the latter furnishes the markers free of charge. They wil be installed by the maintenance division of the Highway Department. The roads will be marked by numbers. In order to carry out this system it will be necessary to re-number the state highways.

Under this scheme each road leading from adjoining states carrying heavy touist traffic will be marked first. The moment the tourist crosses the state line he will know instantly that he is in Colorado.

MINNESOTA ROAD CONSTRUCTION COSTS REACH NEW LOW MARK DURING 1922

Wadena county, Minn., road work costs reached a new low mark in 1922, according to the annual report of Engineer E. S. Ward. During 1922 sixty miles of road were built at a cost of $67,556.16, as against twenty-nine miles for the previous year at a cost of $74,250.98.

CANADIAN GOOD ROADS CONGRESS TO BE HELD AT HAMILTON, ONT., IN JUNE

The city of Hamilton, Ont. has been selected for the tenth annual convention of the Canadian Good Roads Association, and the delegates who will assemble there on June 11, 12, 13 and 14 from all parts of the Dominion will have before them a program which will be more advanced than that presented at any of the previous gatherings of the organization.

From the skeleton program already prepared it is evident that the executive have realised the necessity of emphasising the economic factor in road building, and will seek to provide for the delegates data which will be invaluable to municipal authorities and officials in carrying out construction programs in the future. From every province in the Dominion, as well as from the United States information will be secured as to the details of cost in both construction and maintenance, so that comparisons can be made and highway engineers and public bodies be enabled to ascertain the most economical methods of work, bearing in mind the relation of cost to efficiency and good service.

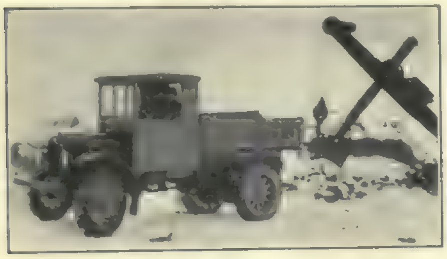
Linked up with the question of cost will be that of the use and abuse of the highways. The builder of the highway and the user of it have in the past failed to realize that they have many interests in common, that improved highways can only be built and maintained if they work in co-operation. Modern traffic conditions have revolutionised highway construction, and at the convention there will be discussions not only on types of roads, but also on the use of them, on the best methods of regulating the traffic of autobusses, of commercial trucks, their speed and load, as well as the question of uniform danger signals and direction signs, headlights, lights on all vehicles and other matters affecting the safety of the users of the highways.

The conventions of the Canadian Good Roads Association have been held from coast to coast during the past ten years, and Hamilton was chosen for this year not only because it is centrally located but it is perhaps the one city from which radiates the largest number of modern improved highways. The province of Ontario has made rapid strides in road building in the last few years and the delegates to the convention will not only have the opportunity of inspecting several of the new highways, but will also have practical demonstration of how these highways are built, for additional work will be in progress in June. Furthermore Hamilton is ideally situated from a scenic point of view, and the delegates will be able to visit the famous fruit district when the trees are in bloom, and also make excursions to Niagara Falls and other places of interest. Two afternoons and evenings will be set aside for excursions to inspect the highways and enjoy the scenic beauties of the district.

Equipment—Trade—Materials

RUGGLES' ROAD BUILDER

The Ruggles Road Builder illustrated is especially adapted to requirements of contractors using the very latest and most approved methods of highway construction. Experience shows the need for special motor truck, developed and adapted for use in concrete paving and in operation of subgrades where the conditions vary from light to heavy hauling, with steep grades or unusually heavy fills. The Ruggles Road Builder provides tractor like pulling power at various rates of speed, without undue strain of its mechanical parts.



The Ruggles Road Builder is particularly designed for use with a standard 21-E concrete mixer, and equipped with dump body to carry tow batches of wet or dry aggregate. Its flexibility permits it to be shifted quickly from one job to another. It is an ideal hauling unit for grading and graveling work. After the road building season is closed, it may be used for coal delivery, or by removing the body and installing a fifth wheel, it maybe converted into a tractor for hauling semi-trailers, thus making an all season motor truck.

The Ruggles Road Builder can be purchased with underbody hydraulic hoist and dump body or automatic gravity and dump body. For contractors who handle dry aggregate the dump body is divided by a center swinging partition to handle two, 4 or 5 bag batches. For wet aggregates, the center swinging partition is removed. For contractors who handle gravel and earth, a 2 cubic yard dump body is supplied, with double acting tail gate and spreading attachment.

CHAIN BELT COMPANY ISSUE NEW CATALOG

The Chain Belt Company, of Milwaukee, have just issued a new 44 page catalog, covering the 1923 models of Rex Paver. The book is unusually well illustrated and many of the operating features are shown with the internal mechanisms exposed so as to illustrate their exact functions. The machines are shown with both full and half length chain treads. Particular attention has been given to the enclosed transmissions which have become very popular with paving contractors.

The Chain Belt Company has manufactured concrete mixers since 1909 and has a large plant devoted exclusively to mixer construction. The company operates its own mallaeable grey iron and semi-steel foundry and with the exception of the power unit and one or two minor items, builds the mixers and pavers entirely in its own shop. Service stations are maintained n aill principal road buildng centers. Any one desiring a copy of the new catalog on Rex Pavers can secure one by addressing the company at Milwaukee.

HUG SPEED TRUCK

The Hug Speed Truck is a product of several years of road building experience. Mr. C. J. Hug, a successful road contractor, realized the need of a motor truck especially adapted to road building service. He first designed and constructed an experimental truck for use on his own road contracts and the remarkable performance of this experimental truck under actual working conditions, its economy of time and money, dependability, efficiency and its practical service, led to the formation of a company to manufacture this truck and other road building equipment.

Records obtained from the many fleets of Hug Speed Trucks in operation today are indeed gratifying and particularly inasmuch as the truck has proven very successful wherever used. Some of these records are as follows: 51 cents per square yard, including all labor and operating costs on 16¼ miles of pavement, on a job where the Hug Truck, Hug Turntable and Hug Subgrading Machine were thought out and developed. The result of this achievement was demonstrated on the Powell-Gauen Co. job near Waterloo, Illinois, where all Hug equipment was used with Hug idea of plant layout. A cost of 23 cents per square yard is reported, or would represent a total saving on 16½ miles (laid with the kind of equipment used in common practice) of $41,160.00. The hauling cost on this latter job amounted to 6½ cents per ton mile for the entire job.

Personal Mention

R. H. Higgins, Superintendent of maintenance of the Colorado Highway Department, having passed a civil service examination, has been retained in the permanent organization. His appointment was temporary, after the passage of the 1821 highway act, until such time as an examination could be held.

John Butter has resigned his position as special highway engineer with the State Highway commission at Ames, Ia., and has accepted a situation with the Miller Construction company of Burlington.

T. E. Doremus, who for the past three and a half years has represented E. I. du Pont de Nemours & Company, as General Eastern Manager for the Orient, with headquarters at Shanghai, China, has returned to the United States. Mr. Doremus is now located at Seattle, Washington, where he is Manager for the Explosives Department of the du Pont Company.

J. L. Duran has been appointed County Superintendent of Highways of Stark Company, Toulon, Illinois.

R. E. Behrens, who for the past two years has been with the Wisconsin Highway Commission, has been appointed County Highway Engineer of Waukesha County, Wisconsin.

Kirk McFarland, formerly engineer of construction of the Missouri State Highway Commission, is engaged in contracting work with M. E. Gillioz, at Monett, Mo.

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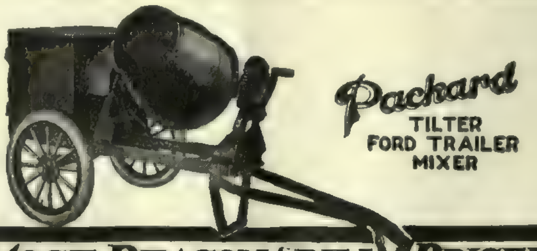

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The Journal of Highway Engineering and Transportation

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIV MARCH 14, 1923 No. 11

How Much Time Is Lost in Delays in Highway Construction

By H. K. DAVIS

Chief Inspector Iowa Highway Commission

IN the State of Iowa during the past two years some studies have been undertaken to determine what is average production on the standard types of construction equipment on highway work. On excavation and embankment work in that state the wheeler and slip-scraper are practically obsolete and no longer appear on the job except for very special purposes such as sand cuts or constricted spaces. The same is true of the fresno except for borrow pits or side hill location. Steam shovels are seldom used except in connection with rock work, and in Iowa this is a small percentage of the whole. The result has been to limit the investigation of average output to the elevating grader so far as dirt work goes.

On pavement construction the mileage of all types other than concrete has been so small during these two years that figures made on these jobs would be of very little value for purposes of comparison. The studies on paving, therefore, were confined to concrete. On the earthwork studies, while some valuable data were collected on averages, not enough information was at hand to enable us to account for all lost time. It is therefore with the lost time on concrete pavement construction that this paper will deal.

The figures here submitted deal with 151 miles of concrete placed in 1921 and 101 miles laid in 1922, not a large program in either year. The merit of the data, therefore, lies not in its mass but in the fact that it was complete and covered average conditions over the area studied, also that it covers all the work done during the two years and not a few particular jobs which might be selected to verify a pre-conceived theory.

Working Conditions

In 1921 the season so far as working conditions were concerned was about what could usually be expected:—

1. Weather conditions were about what can usually be expected. The spring opened early and work started but much time was lost immediately by late snows and rains. Mid-summer weather was good but one extended spell of rain in the fall lost some three weeks of time for all contractors then at work. Winter held off a little later than usual.
2. The labor supply was good and dependable.
3. Shipping facilities were more nearly normal than any time since pre-war days, and caused no delays that are of record.
4. A supply of material adequate to the needs either existed or was developed for the occasion. On only one or two jobs were they delayed for lack of materials to an extent that was noticeable.
5. The work was well distributed over the entire state. Therefore, conclusions drawn from these figures are not limited to a small area where conditions might be very special.
6. The work was well distributed as to size of jobs. No one contractor secured any large block of work in any one location.

In 1921 the work was carried on on 31 contracts, by 19 contractors, using 29 outfits, on 35 separate sections of road, in 17 different counties. In 1922 the work was carried on on 20 contracts, by 13 contractors, using 19 outfits, on 24 separate sections of road, in 10 different counties. The term "outfit" is here used to include all loading, mixing and hauling equipment and their crews which were operated as a single construction unit.

In 1922 the working conditions could hardly be called average in certain respects. The weather was a little better than is usual in Iowa. There were no long rainy spells. In addition winter held off for nearly a month longer than can be depended on as a rule, thus enabling several contractors to finish their work when otherwise they would have had to shut down. In all other respects the conditions were as favorable as in 1921 except as regards railway facilities. Because of the coal and shopmen's strikes many outfits were laid up for long periods waiting for delivery of materials when these same were plentiful at the producing plants. In all respects except these latter two the conditions under which these two years work was done are considered about average for the Middle West, and there may be a lingering suspicion in the minds of some of us that a state of business stagnation caused by labor strikes is coming to be more nearly the normal than the abnormal condition.

Paper presented at the annual convention of the American Road Builders' Association, Chicago, January 15-19, 1923.

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Sources of Information

The figures here summarized were compiled from daily inspection reports sent to the general office of the Highway Commission by the inspectors on the jobs for each day that the job was under way regardless of whether any work was done. These reports give the information usually contained in such reports as to feet run per day, cubic yards, cement content, etc., but in addition show the amount of lost time and the reason for such delay, from the start to the finish of every job. The information contained in these reports was tabulated by heading a column for each construction outfit with a brief description of the work and the equipment, and following down the column with the feet laid for each day, entering on the same line the reason for any delay that occurred on that day. The runs for a given date show opposite to each other on the same line for the entire state. Delays of less than about 45 min. are disregarded, they being considered as a part of the day's work and too small to influence materially the day's run. The runs are given in linear feet since in the great majority of cases the pavement is 18 ft. wide and of a uniform depth of 8 in. A very simple conversion factor is furnished by the fact that one linear foot of 18 ft. pavement represents two square yards of surface.

Incidentally it may be stated that this method of tabulation has the merit of permitting rapid comparison between all the outfits concerned for any given day or period of time. A state-wide rain shows up plainly on the progress made throughout the entire state on that date. Also it shows up in a rather startling manner the power of recovery of the various outfits after such a rain. Those organizations that are well-known for their pep almost invariably stage a quicker comeback than the easy-going ones. When two outfits work side by side and conditions are similar and the weather the same, and one outfit fails to work more than about half the time while the other produces steady results day after day, the natural conclusion is that the difference lies in the kind of management brought to the work by the contractor.

Another point frequently claimed but not as yet proved by the Iowa data is that an industrial railway haulage outfit can be run more days in the season than a truck-haul outfit when the two are operated under the same or equally good management.

Length of Construction Season

In 1921 the first concrete laid was on April 8; the last on November 16th. This covers an interval of 223 calendar days, which has been taken as the length of the construction season for the most venturesome contractor. In 1922 the first concrete was laid on April 27th; the last on November 29th. This made a construction season for 1922 of 217 calendar days. Both of the seasons are considered to have extended a little later into the fall than can regularly be counted on, though only the 1922 season included a greater number of suitable work days than the average. In the construction season of 1921 the 29 outfits laid on an average of 27,525 linear feet of pavement each or about 5.25 miles. In 1922 the 19 outfits averaged 28,021 feet each or 5.30 miles.

In fairness to the contractors on the work it must be stated that this average output for a long season's work is not representative of their producing capacity. This is clearly shown by the fact that several outfits have turned out from 10 to 15 miles in a single season. It is explained by the fact that under existing highway laws Iowa is frequently compelled by the financial situation of the counties to let pavement contracts in units smaller than what would constitute an economical length of run for an outfit for the season.

Average Performances

The average length of season per outfit required by the contractors in 1921 to complete their undertakings was 114.3 calendar days, indicating a reduction of nearly 50 per cent from the possible total of 223. As intimated, this reduction is chargeable to the conditions under which the work was let rather than to any unwillingness or inability on the part of the contractors to carry on for a full construction season. In 1922 the average duration of time on the work was 100.8 calendar days or considerably more than a 50 per cent reduction from the possible 217 calendar days. In any case where a contractor was able to finish his season's work within the construction season it is difficult to see how he can in fairness be charged with the failure to work through an entire season. The findings are reversed when, because of lack of foresight or good management, he fails to make use of all the available time in starting his work in the spring or in running late in the fall and as a result fails to finish.

In 1921 the average output per outfit per calendar day was 241 linear feet. This shows how small a figure should be used in case it is ever desirable to use calendar days as a basis for figuring. In 1922, however, the average per calendar day was raised to 278 linear feet. When Sundays and Legal Holidays are eliminated from the total calendar days in the season a more logical basis for comparison results. In 1921 with the Sundays and Holidays eliminated there remained 96.1 possible working days on the average. The resulting run figured on this basis was 286 linear feet. In 1922 the possible working days averaged 85.7 and the run per day 327.6 linear feet. These runs reduce to about 600 square yards per possible working day as an average for the two years.

Eliminating all rainy days and other stops of an entire day leaves 74.1 days per outfit on which concrete was actually laid during the season of 1921. By the same process the days actually worked during 1922 reduces to 61.2, and not all these days were full days since many of them show only short runs when rain, breakdowns, etc., stopped the work for the remainder of the day. It came as a distinct surprise to most engineers and contractors in Iowa to find that all the concrete pavement laid in 1921 could have been placed in 2.5 months of straight time, and the entire 1922 program in two months, if only the numerous delays could have been eliminated. Yet the work occupied the time of all the contractors and all the engineers for most of the year.

The average laid per day worked also seems like a very conservative figure. In 1921 it was 371.5 linear feet. In 1922 it rose to 457. This increase is very probably accounted for in part by better management and increased efficiency. But another factor is present which is known to be responsible for the major part of it. This is the increase on the average size of the plant equipment. During 1921 the largest outfit on the work was equipped with a 21-E paving mixer or a plant mixer of equivalent capacity, while there were several smaller than this. In 1922, there was only one mixer smaller than a 21-E and several large outfits came onto the work with mixers as large as a two cubic yard capacity. The figures here obtained, if conclusive, indicate that 800 sq. yd. of 8 in. concrete is a safe estimate of the daily capacity of a paving outfit on the average, unless the size of mixers is increased, efficiency raised materially, or some method is found of beating the weather.

The 74.1 average of days on which work was done represents 64.8 per cent of the 114.1 average calendar days in the season of 1921. In 1922 the 61.2 average days worked is 60.7 per cent of the 100.8 average calendar days. The writer recalls having asked one contractor's superintendent what in his judgment was the per cent of time a man might safely count on as available in a construction season. After some thought he gave it as his opinion that 80 per cent was the most that anyone could rely on. To verify his statement his outfit in 1921 came within 1.8 per cent of reaching the 80 per cent he had himself set as a mark. The nearest competitors his firm has had on the Iowa work in two years have not yet passed 74 per cent in days worked out of days spent on the job. Very few have passed 70 per cent and many are around 50.

The days not worked were classified under various heads according to the causes for such delay. The per cent of the total calendar days thus lost was as follows:

Loss Due to	1921	1922
Sundays and Holidays	14.20	13.67
Snow, rain, mud and frost	14.70	9.72
Break down of equipment	1.09	.47
Shortage of material	1.14	9.83
Moving equipment	2.56	2.56
All other causes	1.51	3.02
Totals	35.20	39.27

Attention is invited to the fact that a greater proportion of days were lost in 1922 than in 1921. Also to the fact that delays due to causes within the control of the men on the job average about the same for the two years. Those delays least subject to elimination by the contractor are the ones in which the widest variation shows between the two years. For example, the weather was more favorable in 1922 and contractors lost 4 per cent less of their entire time from this cause than in 1921. On the other hand, the railroad situation in 1922 caused shortages of material which delayed the contractors nearly 9 times as much as in 1921, and caused them to lose 8.7 per cent more of their total

(Continued on page 105)

The Obligation of State Highway Departments to Keep the Public "Sold" on Highways

By H. E. HILTS

Acting State Highway Engineer of Pennsylvania

WHEN one contemplates an illusory sort of a title such as has been given this paper, it brings into contemplation so many vague and unwieldy thoughts that it is presuming on our credulity to attempt to cover the subject but in a general way. We know as road builders, we have something to sell; we know we have to sell it to someone, and we hope that we have some talking points to help us in disposing of it.

A study of the history of transportation shows the necessity for leadership and vision, because people as a rule have been slow in availing themselves of new ideas and new modes of transport. New ideas in transport, like all other commodities, have to be sold. Our present day commercial transport is sold and we are all more or less conversant with the methods used by our shipping service, and our inter and intra state carriers in selling their particular facilities to their clients, both by publicity campaigns and paid agents.

In the field of highway transport, a new mode of common carriage has rapidly developed. It is still young and is still in its pioneer stage of development. It is a mode which if used and promoted conservatively will augment, simplify and make more economical and commercially more remunerative both ship and railway transport. If, however, its powers are spent in endeavoring to usurp the funnctions of the other carriers, it would seem that our new mode of transport will be retarded in its development. In the light of common prudence the agencies of the people, the State Highway Departments should play their part in giving the public authoritative information on highway transport, as it involves the roadbed and right of way.

Broadly speaking, the pay transport is that of the manufacturing and commercial interests, and classified directly these interests have to be sold on the ideas of—(1) "selective" carriage by the motor truck on our highways in contra distinction to the common carriage of the railroad, and (2) in the use of the motor vehicle for short haul traffic. This "selective" carriage is that part of commercial highway traffic that has or will prove cheaper in total cost to the consumer, and it will, therefore, automatically be adopted by industry in preference to other methods of haulage as is evidenced by the moving of furniture, or other selective commodities, long distances in the thickly settled east, and the use of motor trucks by milk, produce, and other interests for movements up to one hundred miles. In general, the commercial interests are exponents of the value of good roads, but there has been a marked laxity on the part of the State Highway Departments in giving out information which is live information, and the spasmodic attempts by personal address have not carried the message of economical use to these people. The commercial interests are appreciating that the highway engineering profession consider road building in the light of a business proposition, and that as in all commercial enterprises, the money which is invested in a good road represents tangible value in giving a more even and satisfactory roadbed, a route that has eliminated rise and fall or distance. They are beginning to appreciate that if bond issue money is used, that tangible value should exist at the expiration of the bond period, and further, that the earning power of the road,

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Paper presented at the annual convention of the American Road Builders' Association, Chicago, January 15-19, 1923.

which begins the day it is open for traffic, should more than offset the money required for upkeep charges, depreciation and obsolescence.

The railroads are the sponsors for the trite remark that highways should be built as feeders to the railroads. There have been few highways built in this country that have not been feeders to the railroad. From the nature of the case, it would seem the greatest feeders entering a given town are the ones that carry the most traffic to and from the town and, therefore, our primary routes are the ones that should be first improved with modern thoroughfares. Many times this viewpoint does not seem to take into consideration the fact that automatically the semi-feeders, the secondary roads, are being constantly maintained and strengthened from current taxation, and that industry can accomplish much by strengthening the aims of the Highway Department in its endeavor to have local road revenues spent to the best advantage. The road builder, the motor truck manufacturer, and the railroads have a common interest in selling the road user reasonable selective traffic, and the sale of the idea that a reasonable load should be carried within the legal limits of speed, and in a vehicle that meets all legal requirements. We must not lose sight of the fact that the real birth of truck traffic was during stormy times, and that overloading and its attendant evils were thrust upon the highways before the remedies could be applied. It would seem that the general crystallization of ideas of all the interests involved is leading to a more conservative gross vehicular load and wheel load, and the research work which has been conducted by the Bureau of Public Roads, and several of the State Highway Departments is being practically interpreted to mean more conservatism on the part of all interests in the general interest of the good road movement.

The Case of the Electric Railway

In the case of the electric railway, we have to handle a different educational sale. The electric railway during its relatively short growth automatically found its level as a feeder or helper to the railroads. It searched out corners of our country which could not be reached economically, due to physical conditions, by the steam lines, and it has done much to raise the tone of the communities it serves. Generally, many of these lines have broadened their activities so as to take in the power or lighting fields. Thus they have automatically become super public service corporations. The motor vehicle in its earlier day did in its unregulated field offer grave competition, as noted in the jitney craze of ten years ago. It was quickly proven, however, that the wide spread use of jitneys was economically unsound, and we now find the regulated motor vehicle used as a common carrier of passenger traffic. In the large centers of population, it has become the taxi, or motor bus, which is recognized as a selective carrier augmenting the electric lines, and it is regulated in its service by the Public Service Commissions, whether or not it competes with existing steam or electric lines. Automatically, this method of common carriage is being sold to the public by necessity, and in its turn it makes for the use of more and better highways. It is interesting to note that the widespread use of commercial bulk haulage by motor truck for long distances has yet to prove its economy.

The largest class of road user, the owner of the pleasure motor vehicle has as yet to be sold the salient idea of highway financing. He does not yet realize that roads cost money, that definite road policies of construction, maintenance and administration are necessary. He does not realize that he has a vehicle that is dangerous to his fellow man when improperly used. The courtesy of the open road has not as yet made its appearance. If the road official does not take in hand and continually sell and resell the idea or road courtesy, he is leaving one of his greatest assets dormant. The selling of such stock phrases as "The man on your right has the right of way," the selling of ideas of correct lighting of motor vehicles, the courtesy of remaining on your own side of the road, the heeding of warning, danger and direction signs, the use of judgment in approaching grade crossings, all are tangible set ideas which all road users should be taught, and in being taught they gradually imbibe a more wholesome respect for the road and their fellow man.

Good Roads Developed Nationally

It is interesting to note in this connection that gradually the owner of a motor vehicle loses his individualism. As his radius of travel increases he realizes that good roads do not mean just a road for his own locality, but that he must broaden his vision and his efforts so that his township, his county or his state are made accessible if he is to derive the full benefits of his new investment. We will always have the stay at homes who will never appreciate the growth and progress of the country as a whole and they, as in the past, will be the greatest opponents of highway progress, but even they are not hopeless as far as highway education is concerned. A few of the states have fostered the touring idea, not in the broad sense of the National Automobile Association, but in the more homely and restricted sense of giving local news items for the smaller dailies and through channels of this kind must the stay at homes be reached.

In all this educational work many look to the State Highway Departments alone. However, this is a restricted viewpoint. If we are to make surer and quicker progress, we must correlate all of the agencies of the State. The business man's viewpoint must govern and regulate the many activities of a state administration, the several departments of the state administration having much in similarity to the departments of an active, well managed business enterprise. In business the exchange of ideas between these departments is conducive to the success of the several departments and the enterprise as a whole. The problems of design, construction and maintenance, and the problems of economics of the highway department are closely associated with the needs of rural transportation. In the eastern states the neglect of agriculture is the paramount cry of those interested in this phase of human endeavor, in the middle and far west the reverse is the case, but in either event, it has been one of the inconsistencies of American progress that the farmer's car has been allowed to remain in the mud. If more attention is given to the construction of good roads, towns will widen and stabilize their trading zones, and agriculture will again in the east, draw its people back to the farm, and thus place life on a more equable plane. The State Department of Education appreciates that hand in hand with its endeavors should go the endeavors and thoughts of the Highway Department, and yet how few and far between have been the spasmodic attempts at cooperation. The graded school can replace the old red school house only after good travelable roads have been built, because only then can every day travel be accomplished.

Yet how seldom is this reflected in the cooperative educational efforts of these Departments. In turn we could discuss joint cooperation with State Departments of Commerce, of Internal Affairs, of Water Supply and Forestry, of Labor and Industry and of Public Service Commissions, and yet, how seldom is this cooperation actually sought by the departments in question.

The obligation of the State Highway Department is not fulfilled merely by selling ideas, for before it can sell anything it has to, like any other business enterprise, have the healthy respect of the people for both its purposes, its judgment and its work. If the people are led to believe that its purposes are political, that its judgment is biased and its work is poorly handled and wastefully done, it can't sell ideas. Therefore, when the general policy of a live department is decided upon, after definite and long continued conferences with the people and with the interdepartment divisions, let the people know—don't hide it. Expenditures are large, tens of millions of dollars yearly in many states, and the making available of funds in future years will be one of the jealous prerogatives of future legislatures. State programs always will depend upon the legislatures as representing the will of the people; therefore, public opinion should be courted. Much has been said of decentralized control as against centralized control. If the public are informed by impartial observers who know the work that the department is a real going concern, if they appreciate that there is a definite policy, close financial control, rigid construction standards, real teamwork in the organization, then they can appreciate that the selling arguments are sound. The concomitants that go with this definite appeal to the public, however, are sound engineering skill in maintenance and construction, and real business contract cooperation with the contractors who accept the state's business.

Establishing Policies

Probably the most important single step that a department takes is the establishment of its policy. Many experts and laymen believe that policy represents the ideas of one man or a group of men. In some cases, this is probably true. It would seem, however, that a strong basic policy will stand only after it represents the consensus of opinion of the thinking people of the state. For instance, prior to beginning the program that has been carried out in Pennsylvania during the past four years, the late Commissioner Lewis S. Sadler, after wide publicity and hundreds of interviews with interested delegations, concluded that it was the idea of the people of the commonwealth that assessed valuations and county lines be ignored in planning for the construction of the Pennsylvania primary highway system, that the viewpoint of the people was to construct a trunk line system connecting centers of population within the state and without the state by reasonable connections with the primary systems of adjacent states. The whole cost of the primary system was assumed by the state, the counties being urged to use their available funds in the construction within their limits, of the secondary system as constituting roads of local importance but not used by the public within the state as a whole. The secondary system could be built either in cooperation with the counties on a fifty-fifty basis, the state funds coming from legislative appropriations, or by the county on a bond issue or current revenue program. As a further policy, which was given publicity in the press throughout the state, it has become generaly known that the state is empowered by legislative enactment to do the engineering work, award contracts, and superintend construction on the request of any county, the county meeting only the cost of the construction work. This enactment has sold to the majority of the counties, the services of an organization equipped to handle their construction work with economy, efficiency and dispatch under standardized state wide methods. Establishing a policy is only one step—it should thereafter be given wide publicity.

The Importance of Economics

There are other policies that are as important as a broad general financial policy. One of these is that which deals with the economics of the road. In Pennsylvania, for instance, one of the great industrial states of our country, we had prior to starting our program, just gone through the trying transportation difficulties of the war. The heavy use of our roads in augmenting the steady flow of war materials by rail brought out in a startling and definite form, the fact that our main trunk highways were not sufficiently strong to withstand the constant flow of supplies by motor truck train from the midwest to the embarkation points on the seaboard. This experience is still fresh in our memories, and to my mind this period, from 1917 to 1919, will be considered as a turning point in our conception of the use to which our primary roads may be put in a time of stress, or a great national emergency. An analysis of this emergency by the public and the engineering organization developed the policy which was given wide publicity in the press, of constructing primary roads of the so-called durable types in active competition, when the engineering division was satisfied that there would be real competition, the work being awarded to the low biddes, irrespective of type. This policy has been rigidly adhered to for the past four years. If a low bidder fails to qualify, his bid is rejected and the work is readvertised. Another policy, which has been given wide publicity in our state, is that if an improved road is needed, it, like any other commodity, has to be bought in the open market. It naturally follows that in a period of high or uncertain prices, large construction programs may needs be deferred, and only the most important construction links be given consideration.

A New Field

It is not self evident that engineering standards of construction can help to sell the public the roads it needs. However, it is rather striking to find that delegations of laymen who visit headquarters will spend considerable time looking into standard bridge practice, look over specimens of road surfaces, and in every delegation there are a few men who appreciate that the present highway engineers are entering in a new field of endeavor; that they are not following out rule of thumb methods of guessing at this or that, but that slowly they are attempting to evolve logical engineering designs to fit the needs of the loads which are or may become legal, and therefore used. The bold designs of the past are being replaced by conservative standards which in the future will bear the light of increasing scrutiny. More and more as the light of truth creeps into the field of highway engineering, the failures of the past will be shown up in their true light as failures not so much of engineering as of the system under which roads have been built; the system which on the one hand calls for extended mileages of secondary types and on the other for short mileages of wide

(Continued on page 106)

Current Events in the Field of Highway Engineering and Transport

PENNSYLVANIA HIGHWAY DEPARTMENT PLANS A TRAFFIC SURVEY

A highway transport survey is being planned by the Pennsylvania State Highway Department. In an announcement by Paul D. Wright, commissioner, it is stated that in this survey "our engineers will consider the importance of feeder territory as to its agriculture, its industries, the population of the towns and cities. They will consider the trans Pennsylvania traffic which will pass through their districts and the logical route for this traffic to follow. They will endeavor to determine through reasonable deduction the probable development of feeder territory. The material gathered in various sections of the state will be studied as a whole; and the result will be a composite picture of Pennsylvania's highway requirements for years to come. We shall determine from the normal road use of the present and the result of our studies of the future what highway types will be necessary. The survey will aid in the conservation of the state's financial resources, because it will give Pennsylvania the best possible road system at the least possible expenditure of public funds."

BILL TO TRANSFER CONTROL OF 132 MILES OF ROADS IN NASSAU INTRODUCED IN N. Y. ASSEMBLY

With the sanction and approval of State Highway Commissioner Greene, Assemblyman F. Trubee Davison, of Nassau, has introduced into the Legislature a bill which provides for an exchange of certain roads in the county road system to the state for certain roads in the county now under control of the state and known as state highways. The bill provides for some transfers that affect the North Hempstead turnpike, from city line to the county highway, in North Hempstead and Oyster Bay townships; Jericho turnpike, from Floral Park village, to Jericho in the same township; Hempstead turnpike, from city line to Suffolk County line, in Hempstead and Oyster Bay townships; Merrick road, from city line to the Suffolk County line in the same townships; the Glen Cove-Massapequa road, from Glen Cove line to Massapequa, in the same townships, and Middle Neck road from North Hempstead turnpike at car barns to county highway, North Hempstead township.

These roads are now being maintained by the county, although they are used largely by persons from all over the state.

Under the provisions of the terms of exchange the county will take over 66.51 miles of State roads, while the State is asked to take over 66.23 miles of county roads, which is practically an even swap. The bill as introduced by Assemblyman Davison allows for the exchange "on condition that after inspection the State Commission finds such county roads to be properly constructed." The county excludes the State from any responsibility for certain parts of the county roads in incorporated villages.

The bill further states that if the commission finds the county roads named in the exchange under proper construction, a resolution to carry out the provisions of the act shall be prepared by the State Commission of Highway and submitted to the board of supervisors.

UNITED STATES WILL NOT PARTICIPATE IN INTERNATIONAL ROAD CONGRESS

Unexpected objection raised during the closing hour of Congress by Representative Garrett, the Democratic leader, resulted in the defeat of the resolution providing for American representation in the Permanent Association of International Road Congresses.

Representative Anderson, of Minnesota, explained that the cost of membership is negligible and that the United States should participate in the exchange of views in the matter of road construction. He pointed out that the proposal not only has the endorsement of the President, the Secretary of State and the Secretary of Agriculture, but in addition was recommended by Secretary Meredith, who was in charge of the Department of Agriculture during the preceding administration. Despite these facts and others presented on behalf of the resolution, Mr. Garrett insisted on his objection just at the time the friends of the resolution were rejoicing in the fact that they had been able to get the resolution before the House. It had been taken for granted that no one would object.

INDIANA STATE ROAD NO. 6 TO BE HARD SURFACED

Surveyors of the state highway commission have started surveying State Road No. 6, popularly known as the old Michigan road, between New Augusta and Shelbyville preparatory to this section being hard surfaced, according to John D. Williams, director of the state roads body.

Mr. Williams called attention that this is one of the principal trunk lines or market highways in the state system. Starting at Madison on the Ohio river, the road passes through Versailles, Greensburg, Shelbyville, Indianapolis, Lebanon, Frankfort, Delphi and at Monticello connects with No. 7. It carries a tremendous amount of truck traffic, particularly live stock and farm products from southeastern counties to Indianapolis markets. The road is paved with concrete between Indianapolis and New Augusta.

NORTH CAROLINA TO BUILD 800 MILES OF ROADS IN 1923

The 1923 highway construction program in North Carolina was put under way February 1 when bids were opened on over 200 miles of road work. Plans for 1923 call for the awarding of approximately 800 miles of work.

PLANS APPROVED FOR NEW BRIDGE AT BEDFORD, IND.

With the approval by the Federal Government of their plans for a huge steel bridge to be thrown across White river on State Road No. 4 at Bedford, the state highway commission of Indiana is prepared to build a $500,000 structure at this crossing, half the cost of which will be paid by the Federal Government.

Mr. Williams, director of the commission, recently received word that the department's plans had been approved by Secretary of War Weeks, and Major-General Lansing H. Beach, chief of engineers of the U. S. Army. While the War Department does not regard White river necessarily as a navigable stream it keeps it under control because of its importance as a tributary to navigable water, with the result the department's plans necessitated approval by government experts before the work could proceed.

William J. Titus, chief bridge engineer, who prepared the plans for the highway commission, states the proposed structure will be 1200 ft. long. It will consist of seven spans, four of which will be 300 ft. long, and three each 125 ft. long. The foundations will be of concrete sunk 15 ft. below low water and are to rest on 40 ft. piling driven far into the river bed. A remarkable incident in connection with the drilling for locating position of the abutments was revealed. Despite the fact the bridge is the heart of the limestone district and outcroppings of stone appear along the river channel, four test holes sunk 90 ft. below the water surface failed to reach bed rock.

Mr. Titus points out that the approaches to the Bedford structure will go over a new right of way and that the people of the vicinity were wonderfully cooperative with the department in securing this, recognizing the importance of such a bridge and what it means to their community. Plans show that the bridge floor will be 50 ft. above the low water stage. The roadway will be 20 ft. wide and of concrete, and the cost of the structure complete, including the removal of 75,000 cu. ft. of earth on the approaches, is estimated at approximately $300,000. One-half this expense will be returned the state through the federal aid provision.

The importance of this structure for facilitating traffic in that section of Indiana is pointed out by Director Williams who calls attention that state road 5 crosses the southern part of the state from Evansville to the Ohio line just east of Aurora. It conects at Bedford with state Road 22, the preferable route for Indianapolis traffic through Martinsville, Bloomington to Bedford. At Mitchell No. 4 connects with No. 5 across to Vincennes. According to highway officials southwestern Indiana traffic, traffic up from several Southern states and from southern Illinois will use No. 4 and the new bridge. Much of this traffic routes to Indianapolis and on to the National road east and west out of this metropolis.

PRODUCTION OF CEMENT INCREASES DURING FEBRUARY

Production of portland cement in February was greater than in January, notwithstanding the fact that there were three less working days. The total output for the month was approximately 7,971,000 barrels, an increase of 86 per cent. of capacity.

The unusually heavy winter movement in cement, which was noted in January, was continued throughout February. 6,022,000 barrels were shipped from the mills during the month, or 83 per cent. more than a year ago. The best previous February was in 1920 when 3,987,000 barrels were shipped. Both production and shipments for the first two months of this year were greatly in excess of any similar period in previous years. Stocks of finished cement at the mills were approximately 13,343,000 barrels, which is about 10 per cent. above the average for the past five years.

ROAD CENSUS IN SOUTH DAKOTA SHOWS STATE HAS 29,785 MILES OF IMPROVED HIGHWAYS

South Dakota now has 29,785 miles of improved road not including that added during last season, according to the U. S. Bureau of Public Roads which has made a complete census in the State. The improved road mileage at the beginning of 1922 was as follows:

Graded and drained	29,237
Sand-clay	26
Gravel, chert, and shale	518
Water-bound macadam	4

The total road mileage of the State is 115,485 miles, as compared with 93,307 miles in 1914, and during the seven-year period from 1914 the graded and drained mileage has increased from 17,072 to 29,237 and the gravel and macadam roads from 234 to 522 miles.

The total revenue in 1921 amounted to $15,248,232, or $198 for each square mile of area, $132 for each mile of road, or $23.95 per capita.

IOWA HAS BIG INVESTMENT IN GOOD ROADS

Recent reports of the state highway commission show that since July 1, 1916, when the extensive road improvement program was begun in Iowa there has been expended about $6,250,000 per year on roads and bridges, including upkeep.

This money has gone into permanent road building. In fact 2,540.28 miles of road have been graded or "built to line and grade" as the engineers express it; 816.82 miles have been gravel surfaced; 314.96 miles paved; 8.54 miles surfaced with oil macadam; 3,261 bridges and culverts have been built and 1,711.2 miles have been tile drained.

In this putting of the roads to grade and construction of permanent bridges the primary roads have been shortened in every instance possible, as many railroad crossings avoided as could be and routes changed so as to avoid heavy cuts or fills.

Last year in the period from January 1 to November 1 there were 939.58 miles graded, 352.16 miles gravel surfaced, and 98.66 miles paved.

NEW YORK HAS LARGE HIGHWAY PROGRAM

Reporting on conditions of highway contracts in New York State, Colonel Greene, the new highway commissioner, recently stated that there are in force 203 unfinished contracts for constructing and reconstructing 851 miles of road, on which less than 35 per cent. had been paid for work performed up to March 1, 624 miles of pavement remaining to be laid. In addition, contracts had been let for 537 miles of pavement, which is 145 miles more than were built during the entire season of 1922. Of the contracts let in 1922 less than 105 miles have been completed and only 13 miles have been finally accepted. There are 88 miles of pavements still to be built on contracts carried over from 1921.

From these figures it would appear that New York State will do a good season's work if it completes the contracts already made without entering into any others this year.

Texas Company Issues Booklet on Paving Filler

Asphalt fillers for brick and vitrified block pavements is the subject of the newest addition to the comprehensive set of paving booklets which have been prepared by The Texas Company. The new booklet covers the subject from the arrival of the asphalt on the job in barrels and drums. Then with the aid of many illustrations it clearly and thoroughly describes each step involved in the preparation and application of asphalt filler up to the spreading of the dressing material and the admission of traffic to the new pavement. Copies of the booklet may be had by addressing The Texas Company, Asphalt Sales Department, 17 Battery Place, New York City.

Recent State Highway Publications

"Survey of the Fiscal Policies of the State Highway Department of Pennsylvania" by Wm. H. Connell, formerly Chief of the Highways of Philadelphia.

Report of the California Highway Commission for 1922, 214 pages, and a map. Contains specifications for State Roads and Bridge Construction.

TRANSPORTATION TO BE MAJOR TOPIC AT ELEVENTH ANNUAL MEETING OF CHAMBER OF COMMERCE OF THE UNITED STATES

"Transportation in All Its Phases in the United States" will be the keynote topic considered at the eleventh annual meeting of the Chamber of Commerce of the United States in New York, May 7 to 10. Because of the interest of business men through the country in the subject it is expected that the convention will be one of the largest ever held by the Chamber. Representative business organizations in every State in the Union have been asked to send delegates, and an attendance of from 4,000 to 5,000 business men is looked for.

Already the National Chamber is engaged on a comprehensive study of the whole problem from every point of view, hoping to aid in the ultimate formulation of a national transportation policy. That study, however, has been intrusted to a Transportation Conference created by the National Chamber and its conclusions will not be available for months in all probability. Special committees of the conference, dealing with specific divisions of the general question, will be in session at the time of the annual meeting and the discussion of transportation subjects at the big meeting in New York naturally divides itself into lines similar to the committee work of the conference.

Representatives of railroads, shipping interests, producers, the motor industry, waterway operators and the public are included in the conference make up and also will be heard before the annual meeting. The aspects they will discuss at the meeting include governmental relations to transportation, railroad consolidations, rate schedule readjustments, coordination of motor transport and waterway carriers.

Elliot H. Goodwin, resident vice-president of the National Chamber, recently pointed out that the transportation problem was a purely domestic question which "can and must be solved by American business genius." The annual meeting will provide, he said, a far-reaching review of transportation.

"No factor in our national life is so universal in its application as the need of adequate means of transporting our goods," Mr. Goodwin said. "Business prosperity—and that means our greatness as a nation—depends on finding the right way to deal with our carriers by rail or water or highway. Concern in this regard is manifest in every department of our national life, in farming, mining, manufacturing, distribution and nowhere more than among railroad executives. There is necessity for adoption of a national transportation policy. Our tonnage is growing; railroad ton-miles have almost trebled in twenty years. What will they be in another twenty?

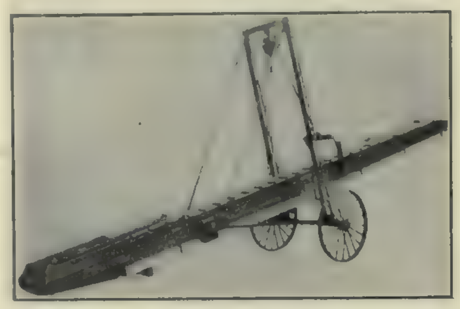
"Men of the business world feel that there must be a way to harmonize operations of trains and trucks and water carriers to make our transportation system capable of any expansion that our commercial growth demands. But involved in such a project is all the question of planning for national treatment of transportation; insurance of protection for the proper public interest in railroads and at the same time restoration of confidence among investors in the railroads and their management; revision of the railroad rate frame work so that traffic will not be stifled, yet providing such revenues as will make the carriers living, expanding industrial entities.

"It is not to be expected that a transportation cure-all can be evolved overnight at the coming annual meeting of the National Chamber. It is to be expected, however, that the meeting will foster and stimulate discussion both among business men and the public. Men who are recognized nationally as authorities on transportation will be among the speakers and the annual meeting, while not attempting itself to offer a transportation solution, well may have an important influence in helping to develop national thought on this vital subject.

"Proposals for solution of the transportation problem have been varied. Some would turn increasingly to motor truck movement of freight, some to waterway developments. All of these proposals are to be presented before the delegates at New York. The annual meeting will serve the purpose of acquainting thousands of delegates with the ebb and flow of national thought on the whole subject. It will be a stepping stone to the day of a national transportation policy, to intelligent consideration of the forthcoming conclusions of the Transportation Conference."

LINK-BELT SLASHES PRICE ON PORTABLE BELT CONVEYOR

The Link-Belt Company of Philadelphia, Chicago and Indianapolis, announce that the price of their Portable Belt Conveyor, the "Cub," has been slashed over 16 per cent. This machine, illustrated, formerly sold for $700. The new price is $585 complete with 2 H.P. electric motor, and bears the Link-Belt guarantee.



Prices generally are on the up-grade, and it is somewhat unusual to learn of price reductions at this time. The Link Belt Company claims that due to the large volume of orders on hand, surpassing anything experienced in several years, the "Cub" loader was put on a quantity production basis, resulting in a large saving in manufacture which is reflected in the new low price.

The "Cub" weighs almost twice as much as similar machines of its size and class. The 18 in. wide conveyor belt is guaranteed against cutting or fraying, and at the speed at which the conveyor belt should run (250 ft. per min.), and with uniform feeding, has a capacity of 45 cu. ft. per min.

G. E. Farnsworth, until recently a resident engineer with the Oregon State Highway Commission, has been made assistant engineer of the road department of the County of Riverside, Calif. He is stationed at Santa Monica.

Personal Mention

F. W. Epps, for the past five years bridge engineer of the Kansas Highway Commission, has resigned and entered consulting bridge and road engineering with H. S. McFadden, under the firm name of the Kansas Engineering Co. This firm has been doing road work in Kansas for the past four years. Mr. Epps is secretaary of the Kansas Section of the American Society of Civil Engineers, a member of the executive committee of the Kansas Engineering Society, and president of the Topeka Engineers Club.

Fred Grumm has been appointed office engineer in the headquarters office of the California State Highway Commission at Sacramento. Mr. Grumm goes to Sacramento from the Fresno office where he has been located recently as assistant division engineer.

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Delays in Highway Construction

(Continued from page 99)

days. This quickly ate up all time saved on all other causes and left them behind as much as they otherwise might have been ahead.

Sundays and Holidays and weather, as might be expected, make the largest draft on the contractor's available time. Break-downs that cause a whole day's delay are rather noticeable by their absence. Apparently most up-to-date contractors have solved the problem of providing against delays of this sort by having on hand a stock of repair parts and a good live man to see that they are used. Moving and reerecting of equipment seems to take up a larger amount of time than most of us would suppose.

"All other causes" for days lost include shortage of water, shut-downs to do grading work, shut-downs by the engineer or inspector to correct defective work, shortages of labor, strikes, etc. They are each one so small as not to justify separate classification.

The fractional days lost are classified under the same headings as the whole days with the exception of Sundays and Holidays. The percentages are as follows:

Loss Due to	1921	1922
Snow, rain, mud and frost....	12.41	10.31
Breakdowns of equipment ...	5.21	5.24
Shortages of material	2.51	3.25
Moving equipment	1.58	3.78
All other causes	4.55	6.70
Totals	26.26	29.38

These totals of 26.26 and 29.38 represent the percentage of days worked on which some considerable delay occurred due to some cause or other. The average of actual days was 19.25 for 1921 and 18 for 1922. Subtracting these from days actually worked leaves 54.7 days for 1921 and 43.2 for 1922 as the total number of full days worked on the average by all the outfits in the State. On all the other days worked occurred some considerable delay that prevented them getting in a full day.

The low efficiency apparently indicated by many of the figures here given may lead to the thought that the contractors on the Iowa pavement were a small calibre bunch. As evidence that this is not true some of the individual records are here appended. While there is no instance set new marks for the contracting fraternity to shoot at, it is believed that they show that the organizations which have laid the Iowa pavements are well organized and alive to the necessities of their jobs.

One contractor between June 16 and July 30 inclusive, 45 calendar days, worked every day but the 7 Sundays and Holidays, or 38 successive working days, laying in that time 20,658 ft. of 18 ft. pavement. This was an average of 543.5 feet per day or 231½ cubic yards of concrete. Another contractor using two separate outfits, worked both outfits every calendar day for 34 successive days from September 21st to October 24, 1921, laying in this time 29,347 linear feet of 20 ft. pavement 8 in. thick with integral curb and gutter. This was a total of 5.56 miles or an average of 432 linear feet per day. Reduced to cubic yards this made 218 cubic yards per day per outfit. Not the least interesting feature of this run was that a weighted average of the haul shows every ton of this material hauled a trifle over five miles.

(To be concluded.)

At this time last year

They were cutting ice on the Columbia River Highway—chopping through drifts and piled up ice and snow on a road of

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Keeping the Public "Sold" on Highways

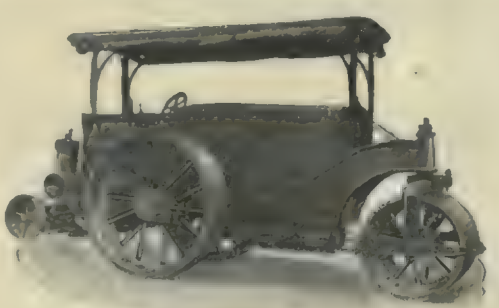
(Continued from page 101)

suburban thoroughfares. It is true that some engineers still live in the memories of the past; they think in terms of 1910. In 1910, Pennsylvania only registered as many motor vehicles as have registered in a single day during the past month.

Probably one of the most important field policies, and one on which the public must be not only sold by telling, but repeatedly sold by retelling, is that of correlating construction with maintenance. A workable theory is that maintenance means not only the maintenance in the densely populated states, of the old roads, but also the improvement by current revenues of the rural roads which are in a primary system, and which are not yet susceptible to the expenditure of bond monies for their improvement.

When the maintained main routes become increasingly burdensome year by year, not only on account of maintenance or other expenditures, but also on account of burdensome hindrance to economical vehicle or transport operation, then correlate these sections by durable construction. This correlation means a detailed study month by month, and year by year by the maintenance and construction engineer; it means study not only in the field, but also in the office after yearly charges have been segregated. An annual program involving 500 miles of resurfacing year by year surface treatment of 1800 miles a year, and construction of durable types at the rate of 500 miles a year must needs be correlated, so that economical expenditures be planned and made, and the details of a program of this character have to be sold to the public through the press, and by pointed constructive talks and lectures. The public must be made to realize that highway work is a great continuing business which cannot be tampered with.

The total yearly volume of sales of a State Highway Department to the people of a state is anywhere from $12,000,000 to $45,000,000 per state, striking an average of say $20,000,00. Can we gather any light by comparing this average department with an efficient corporation doing this gross business a year? Does the corporation spend money to make sales, does it spend money to create desire for goods, does it spend a conservative sum for research and for increasing the efficiency of both the employee and the plant, and when all is said and done are these sums conservative with the ends achieved? You will say yes. Analyze the municipal, county or state highway department. Does it usually make any effort, not to spend money for publicity purposes, but to create desire for roads through channels that are opened freely to them, does it allow in its budget anything for research or refined design practice, or does it organize for efficient publicity work? Most of us will admit broadly—no. Still when the public asks as to taxes, indifferent service, poor maintenance, misinformation, inferior detours, unanswered construction complaints, and all the other miscellaneous complaints that buzz throughout the year, we find that they all can be summarized to come under the broad general publicity outline. The only conclusion that can be drawn is that we haven't still perceived the business man's viewpoint. Enthusiasm must be created for our work, our job and the things yet to be accomplished, because in the end it is the spark of enthusiasm that sells or builds or creates great enterprises.



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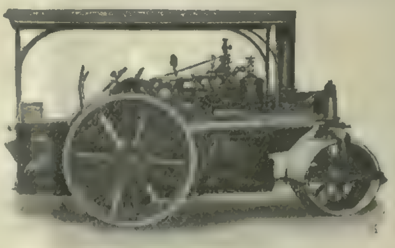

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Vol. LXIV MARCH 21, 1923 No. 12

Lincoln Highway Nears Tenth Birthday

$47,000,000 Invested in Nine Years in Route Improvement—243 Miles Built in 1922—Cross-Country Travel by Motor Increases 100,000 Per cent in Decade

By A. F. BEMENT

Vice-President The Lincoln Highway Association

IF the six or eight intrepid souls who undertook to cross the American continent in a motor car in 1913 join the caravan of fifteen or twenty thousand cars which in 1923 will flow east and west along the Lincoln Way between the two coasts, they can best appreciate the marvelous changes of ten years.

The fact is the whole history of American road-building on anything like a national scale is comprised within the past decade. When the Lincoln Highway in its larger sense as a great main line for a national highway transportation system was nothing more than an idea, a hope in 1913, many ridiculed the visionaries who foresaw the expenditure of so vast a sum as $20,000,000 on the road between New York and San Francisco within a period of even twenty years.

Vast Improvement in Nine Years

In the nine years ending with the advent of 1923, over $47,000,000 had been expended on the improvement of the Lincoln Highway—enough at an average of $20,000 per mile to construct 2350 miles of the route or more than two-thirds of it. The fact is, more than two-thirds of it has been built, if by "built" is meant the completion and opening of a road satisfactory for the traffic of the present.

Each year since the inauguration of the work of the Lincoln Highway Association has seen the construction of between 7 and 10 per cent of the total distance and has witnessed the extension of adequate maintenance over a longer and longer mileage of the completed work. The eleven states traversed by the Lincoln Way built 235 miles of the route with the aid of the Federal Government in 1922, this work costing in total $4,678,041.71, or an average of practically $20,000 per mile. Maintenance on the Lincoln Way during 1922 cost $1,368,126.39 so that the total amount expended on the betterment of the route last year was $6,046,168, an amount slightly less than the average of the past five years.

At the recent annual meeting of the Board of Directors of the Lincoln Highway Association, it was estimated that by the end of this year, taking into consideration the existing contracts, over $50,000,000 will have been expended on the improvement of the Lincoln Highway. It was further estimated that at least $20,000,000 more, i. e. an amount equivalent to what it as assumed ten years ago would complete the route, will necessarily be invested in additional improvement to open up a road satisfactory for the traffic across each state.

From these estimates it is evident that bringing "the Nation's Main Street" to a satisfactory status of improvement will require a total expenditure of some $70,000,000. At the rate of five or six million dollars a year, a sum less than the average expenditures of the past five years, the first completion of the route can be foreseen about the end of 1925. Of course the route will be in splendid condition for the greater part of the distance long before that. It would be open in its entirety, without the possibility of any real difficulties, for the heavy traffic of 1923, were it not for the stubborn refusal of one state to complete a short and important link. As it is, the coming season's traffic will have to take its chances as usual on the short Utah desert stretch.

The condition of the Lincoln Highway in each of the states traversed is a live subject of interest to motorists now in every part of the Union. The Lincoln Highway Association reports the accomplishments of 1922 and the status of the route in each of the states, briefly as follows:

New Jersey

In 1922 New Jersey built 5.6 miles of Lincoln Way to the highest modern specifications pavement 11 in. thick and 32 ft. wide, necessitated by the tremendous volume of travel between New York and Philadelphia. Subsoil conditions under the Lincoln Way at many points require an intricate system of under-drains in order to insure stability and the cost has been correspondingly high averaging over $150,000 a mile. The average cost

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of maintenance on the Lincoln Highway in New Jersey during 1922 was $2,726.00 per mile. The road was kept in perfect condition.

Pennsylvania

Pennsylvania completed 7.24 miles of new concrete construction on the Lincoln Highway last year at a cost of $439,033, or an average cost per mile of $60,723.75. Consistent progress is made by the State each year on its program of reconstructing the Lincoln Highway between Philadelphia and Pittsburg with concrete. The maintenance on the old macadam while perfect is very expensive, averaging during 1922 on 320 miles of the route $1,744.86 per mile, an average materially below that of 1921.

Ohio

A relatively small amount of new improvement was accomplished on the Lincoln Way in the Buckeye State last year. For some years Ohio has been proceeding at the rate of about 20 miles a year, but in 1922 constructed but 9.13 miles of new pavement, this being vitrified brick on a concrete base and costing $372,718.49, an average of $40,823.50 per mile. The new pavement completed was largely between Ashland and Mansfield. The remainder of the required improvement between those two points is to be accomplished in 1923, completing a paved road from the Pennsylvania State line to Mansfield. Road conditions west of Mansfield are spotty and long sections of old macadam are likely to be rather rough during the season of 1923. Ohio spent $40,430 on the maintenance of 113 miles of the Lincoln Way last year, an average of $356.52 a mile, mostly on the old macadam sections.

Indiana

The Hoosier program of Lincoln Highway improvement has been one of the most consistent of any of the states traversed by the route, with the result that the end of 1924 will doubtless find the road completed from Fort Wayne to Chicago. In 1923 Indiana built 25 miles of new concrete pavement on the Lincoln Highway at a total cost of $766,000, or an average of $30,640 per mile, exclusive of the special "object lesson" project built by the Lincoln Highway Association with funds contributed by the United States Rubber Company—the "Ideal Section" in Lake County. The pavement of this model stretch of road was completed in 1922 but many refinements remain to be accomplished in the spring, including the installation of the illumination, the landscaping of the right-of-way and the provision of a pathway for pedestrians. With the completion of the Ideal Section in 1923, Indiana will have as a portion of her trans-state road the finest and most modern section of highway in the world. It will set the pace for adequacy and permanency along the route between Chicago and New York for many years to come.

Indiana spent $89,790 on the maintenance of 141 miles of Lincoln Way last year, an average of $635 a mile. Much of this was spent on the unpaved sections of the route, aggregating some 60 miles, one-third of which at least will be built this year to the same high standard.

Illinois

Illinois would have finished the Lincoln Highway entirely across the State—172 miles—in 1922 had it not been for delays in securing required right-of-way between Aurora and Plainfield where the new pavement will shorten the route considerably. This section and a short gap near New Lenox, totaling 17 miles are all that remain to be done. State Highway Engineer Older expresses the hope that this year will see the completion of the route, a remarkable accomplishment when it is remembered that in 1915 there was not a mile of pavement on the Lincoln Highway in Illinois outside of municipal limits.

Last year Illinois built 2.5 miles of new concrete pavement at a cost of $70,658.62, an average of $28,263.45 per mile. The cost of maintenance was largely restricted to the work necessary on the unpaved stretches which comprise rather poor gravel and carry a very heavy traffic. Maintenance on 110 miles of the route averaged $300 per mile.

Iowa

Iowa took another long step toward the completion of a proper road from the Mississippi to the Missouri in 1922, completing 49.8 miles, which included 14 miles of concrete paving. The permanent grading of the Lincoln Way for 380 miles across the state is very nearly accomplished and only a very inadequate road law in Iowa prevents rapid pavement of the Lincoln Way and of other important roads in the State.

The average cost of improvement per mile on the Lincoln Highway in Iowa last year was $16,118. The entire route is under State maintenance and the average cost per mile in 1923 was $351.85.

Nebraska

Very little complaint can be made of the condition of the Lincoln Highway across Nebraska. Some 15 or 20 miles of the route were in rough shape during 1922, but the State maintains those sections which have been adequately improved in excellent shape and in dry weather tourists of 1923 can anticipate a boulevard from the Missouri River at Omaha to Cheyenne, Wyoming, nearly 500 miles. Nebraska built 69.9 miles of Lincoln Way in 1922 at a cost of $527,000, the average cost per mile being $7,571.85. With the exception of 6 miles of paving in Douglas County (near Omaha) this was all 36 ft. gravel. There is no pavement on the Lincoln Highway in Nebraska beyond 60 miles west of Omaha, but the Platte River gravel makes a wonderful road-bed. Maintenance cost the State about $100,000 last year on 463.5 miles, an average cost of but $237.30 per mile.

Wyoming

As in the past, Wyoming made splendid progress on her program of Lincoln Way Work in 1922. The road is the most important in the State and is rapidly nearing completion. The only serious need for improvement remaining is on that section immediately west of Green River. This project involves an entirely new location and a new bridge, together with an overhead crossing of the Union Pacific Railroad. This will be undertaken in 1923 at a cost of $161,000 and when completed will open the last link in a trans-Wyoming Lincoln Highway—a splendid boulevard for 460 miles.

Last year the State completed 24 miles of high-grade gravel surfacing, at a cost of $135,433.12 and maintained the entire route across the State in excellent condition at an expense of $77,860.00 or an average of $170 per mile.

Utah

The State of Utah is completing a very fine road from the Wyoming line into Salt Lake City. West of Salt Lake City it is doing nothing, all efforts being concentrated on the improvement of a road leading south from the State Capitol to the Arizona line. The south road provides a connection with Los Anngeles thru the heart of the Mojave Desert but is of no service to thru traffic seeking Northern California. The condition of the Lincoln Highway in one county of western Utah is now the only remaininng barrier to easy and certain passenger and freight transport between the two coasts. The desert link in the Lincoln Way, which the Association has been endeavoring for ten years to open, is still at the mercy of the elements. It must be remembered that the Salt Lake Desert is not a vast area. It is but 17 miles across the narrow arm traversed by the Lincoln Way. Here was spent the $100,000 contributed by the Association toward the construction of a graded and gravelled passageway. The State, which spent the Association's money, agreed in 1918 to complete this route and keep it open. It has not done so and without maintenance the expensive work accomplished is being rapidly destroyed by both traffic and the elements. In favorable weather this link will be open during 1923. There is no other way west into Northern California except the long detour north around Great Salt Lake through Brigham and Snowville which is extremely rough.

The State has spent no funds whatever on the improvement of any road west from Salt Lake City since 1919. No new construction was accomplished on the Lincoln Highway during 1922. A few thousand dollars was expended on the maintenance of the road east of the Capitol.

Nevada

Lincoln Highway improvement in the Sagebrush State is proceeding very satisfactorily. With the aid of funds contributed by the Lincoln Highway Association to assist the counties and the State in meeting Federal aid, every indication points to the completion of the route across Nevada by the end of 1924. Contracts now in force between the Lincoln Highway Association and the Nevada Department of Highways call for the completion of 73 miles of the route at a total estimated cost of $707,000 by the first of June, 1924. These contracts involve $52,000 of the Association's funds, this sum being held in escrow in Reno. Altogether the Lincoln Highway Association has extended financial assistance to Nevada in the sum of $115,000, an amount which commands for the State from the Federal Treasury close to half a million dollars.

Last year Nevada completed 48 miles on the Lincoln Highway at a cost of $435,171.23. This work included the completion of the notorious 12 miles of Fallon Sink in Churchill County, which eliminated the worst section in the State. The remaining stretches to be constructed

(*Continued on Page* 116)

The Relation of Adequate Highway Transport Facilities to National Defense

By MAJOR GENERAL LANSING H. BEACH

Chief of Engineers, U. S. A.

WE are apt to overlook many factors connected with things of every-day life. Roads are something which all of us have known from the very beginning. I find, though, that until the advent of the automobile, people living in cities did not appreciate or understand the condition of country roads, and especially the people living in those portions of the country where there was a good supply of stone, did not realize the conditions in those portions of our land where stone was not available. I have seen roads in Southern Louisiana that were absolutely impassible. On that account it seems to me that the people of the cities should not judge what a road is by anything that they have been accustomed to in their own lives.

Six years ago, if the statement had been made that good roads are essential to national defense, it would have created only a mild interest. Today, there are many who can give first-hand evidence of the truth of that statement from their own experience in the training camps of this country, or on the front-line in France. The term "national defense" does not involve solely protection against an invader, but includes as well the preservation of our social and economic life from internal disorders.

It is probably not a well-known fact that the terms "engineer" and "engineering" originally applied only to military men and matters, and it was not until the middle of the eighteenth century that the name "civil engineer" was first used to cover those in the profession who devoted their time to civil works as distinguished from military. At first, not only were all engineering works planned and constructed by military men, but in engineering, as in many other professions and sciences, progress was due to the needs of national defense and the necessity to resist the rapacity of others. This is preeminently true in the realm of highway engineering where the primary object of such roads as were built by the ancient races was to facilitate the movement of troops rather than to develop commercial and social welfare.

Roads are a concomitant as well as an evidence of civilization. The earliest civilizations confined to the fertile lands bordering the Nile, the Tigris, the Euphrates and the eastern border of the Mediterranean had none worthy of the name. Each of these centers conducted such interior communication as was required, by water, on horseback, or by beasts of burden. Trade between the centers was restricted to what we would now term small boats or to caravans which crossed the intervening desert at will, ignorant of such a thing as a highway. Wheeled vehicles are referred to early in history, but they were confined to the chariots used by warriors. Greece was so small and so cut up by many bays and arms of the sea that it did not feel the need of overland routes.

It was not until the rise of the power of Rome that the necessity for a central government to maintain control over a gradually increasing domain and to hold in subjection or to win over as citizens the inhabitants of these conquered lands demanded a method of communication with localities not accessible by waterways, and

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Abstract of an address before the Second National Conference on Education for Highway Engineering and Highway Transport held in Washington, D. C., 1922.

one by which troops could march and move their baggage more rapidly than over the rough trails which were all that those lands had previously known. The result was the wonderful system of Roman roads penetrating to all parts of the Empire, so well constructed that many exist to this day in spite of two thousands years of weather and the destructive hand of man. During the Middle Ages, travel by wheeled vehicles fell into disuse, the nations were disrupted by petty wars between rival feudal chiefs, in which such roads as existed were regarded as a way for the invader and were largely destroyed as a means of defense. The use of roads for communication was practically abandoned; all travel was by caravan of pack animals or by individuals trusting to luck or to detour to escape the robber.

Military Necessity Stimulated Road Building

With a few instances to mark the exception, construction of new roads and the maintenance of old ones were discontinued until the urge of military necessity again stimulated this phase of the engineering profession and it is to the military expeditions of Napoleon that France owes its wonderful system of national roads, without which there is grave doubt as to whether the result of the World War might not have been entirely different. In our own country, the development of highways was exceedingly slow, but even here the Army was one of the important agencies in the work. The Cumberland or National road leading from Washington to St. Louis was commenced as a post road, but it was completed by, and most of the work throughout its length was performed under, the War Department. Many of the present southern and western highways owe their inception and construction to the need of getting supplies to our frontier posts. In our outlying possessions, the Philippines, Hawaiian Islands, Panama and Alaska, many roads have been constructed under the supervision of the Army, and while the commercial needs of those places have been considered, yet the prime factor in the location of the roads was their use for the military in case of need.

When our army first entered Cuba, roads were almost unknown; all that had been built during three centuries of Spanish occupation being less than 400 miles in length. These, however, hardly deserved the name of roads, being full of ruts and mud holes and impassable during wet weather.. Immediately after the second intervention, road construction was commenced by the American forces. The so-called roads were repaired and 470 miles of new road made. While this work was done nominally under the Department of Public Works, it was placed in the hands of the Corps of Engineers of the Army, officers being in charge and the enlisted personnel acting as foremen. These roads are of great value for commercial purposes, but their construction was really a military necessity undertaken to provide means of rapidly moving troops to threaten points in case of an insurrection. The roads and trails in Alaska have for years been under the charge of the Secretary of War and have been built under the supervision of officers of the Corps of Engineers of the Army. During the sixteen years between 1905-1920, a total of 4,890 miles of roads and trails had been constructed. Of this amount, over 1,000 miles were wagon-roads and over 3,000 miles, trails.

I have attempted thus hastily to show that, in ancient history and even into more modern times, highways played an extremely important part in the movement of armies and in the defense of nations. Let us for a moment consider the modern aspect of this question. An army in the field must be properly supplied if it is to be of value to its country. The extremely hackneyed statement, that an army travels on its stomach, is so apt and expresses so clearly the facts in the case that it has been repeated and reiterated again and again ever since Napoleon gave utterance to the remark. In a modern army, the simile must be extended to the whole as an organization and not confined to the anatomy of its human components, and must include all those things which an army needs for its effective operation. It cannot exist without food, clothing, shelter of some kind, artillery, and ammunition, as was the case in former wars when the sizes of the armies were so small that many, if not most, of the needs could be supplied from the territory occupied and the consumption of ammunition was insignificant as a result of the short range and slow methods of loading.

The Highway to the Marne

To a certain point behind the lines, all these impediments can be carried by railroads or by waterways if such are suitably located. Beyond that point, railways and waterways cannot operate, and although for a short distance, under exceptional conditions, a small amount of material may be carried on narrow-gauge railroads, the main bulk must be moved forward by wagon, by truck or by pack train. As the carrying capacity of the last mode of conveyance is very limited, its application is correspondingly restricted, and it may be stated that practically all material for a modern army must be moved from the rail head to the army by wheeled vehicles and consequently over roads of some description.

In determining the amount of ocean tonnage required during the World War, it was estimated that for each man fifty pounds of supplies of various kinds would have to be received in France each day. As this figure included the materials required for the men in rear of the fighting line as well as for those actually at the front, a fair estimate for the latter is thirty pounds per man per day. Reducing this to tonnage, we find that, for an army of one million men, 15,000 tons will have to be transported to the front each day over the roadways leading from the extreme limit of rail transportation to the various units of the army. From the front there is a continuous stream of empty vehicles and those carrying the sick and wounded, as well as troops relieved for their brief period in rest areas. The length of this critical road system depends on the type of warfare being waged. If the forces are intrenched as they were for several years in France, this distance is reduced to a minimum, possibly 10 to 15 miles. If, on the other hand, the war is one of movement where the troops are continually pressing forward, this distance steadily increases, for if the movement is successful the rail head cannot be pushed forward as rapidly as the troops advance.

Let us now turn to our own specific problem, the defense of the United States, and determine how far that statement applies. The defense of our seacoasts rests primarily on our Navy, for while we maintain our command of the sea, no foreign power dares take the risk of sending an expedition to land on our shores. It is conceivable, on the other hand, that due to overwhelming numbers or for other reasons our vessels might be compelled to seek safety in harbors under the protection of our coast forts or mobile railroad artillery. There are, however, long stretches of coast line undefended by permanent fortifications and many miles from any railroad, which would at points afford landing places for an active and daring opponent.

Under our adopted system of defense, our coast line is divided into sectors, in each of which would be mobilized, in case of emergency, a force whose strength would depend on the strategic importance of the sector and the number of places therein where the enemy might land. This force would, however, not be broken up into small detachments at each possible landing place, but would be held as a main body at some suitable central location with small observation and resistance patrols at the critical points along the coast. In case of an attempted landing the main body would be rushed by forced marches or by motor trucks to the scene of action. This system of defense demands good roads, leading from the central point to the various critical points along the coast and similar roads paralleling the coast at no great distance—good roads for men on foot, for animals, for trucks and for the various heavy pieces of machinery which accompany and form part of a modern army, such as tanks and mobile artillery. It might be stated in passing that such machinery, weighing as it does in the individual piece up to twenty or thirty tons, requires highway bridges of a greater weight-carrying capacity than many of those now in use upon our country roads or under construction.

What has been said in regard to our coasts applies with even more force to our land frontiers, for, while on the coast feasible landing places for large forces are not many, our land frontiers are subject to being crossed at many places.

Road Vital to Country's Defense

Permanent road construction is slow and expensive, the work cannot be performed after the need arises, but must have been completed in most part before the emergency occurs, and for proper defense any system of roads must be based on careful study and planning. It may be vital to our national life that highways not only be constructed along our coasts and frontiers, but also that those highways be so located as to lend themselves to the movement and supply of troops needed for the defense of these coasts and frontiers, and for the rapid transfer of troops and impediments from one threatened point to another.

To indicate how far behind the ideal we are in this regard, I will cite the recent movement of a regiment of mobile artillery from Camp Jackson, S. C., to Camp Eustis, Va. The regiment which made this move was equipped with 8-in. howitzers and 155-mm. G. P. F.'s. Of the two guns, the latter had its weight fairly evenly distributed on both axles, but in the case of the howitzer the rear axle carried 10 tons, and this weight was the chief problem in connection with the crossing of the column over bridges. Before the move was started a reconnaissance was made of the various roads which might be taken. The most direct was the Indian Trail and Atlantic Highway, but the idea of using this route had to be abandoned, due to the unfirm roads through the sandhill section of the Carolinas. The next to be considered was the Great Lakes-Atlantic Road. This could be followed in part only, due to stretches of narrow and muddy roads and also to the condition of bridges at certain of the streams which was such that the expense involved in strengthening them sufficiently to carry the weights of the guns was out of the question. It was finally necessary to select a route which increased by a third the distance to be traveled and over a road which lay from 100 to 200 miles back from the coast. The column was accompanied by a detachment of engineer troops which was busily engaged throughout the whole trip in strengthening weak

(*Continued on Page* 116)

Delays in Highway Construction

(*Continued from March* 14 *Issue*)

The bulk of it was hauled over a hill road containing seven adverse 6 per cent grades and many smalles ones. A large share of its was hauled up a single grade 9,000 ft. long a part of which was 6 per cent and which had a number of curves. Practically all the remainder was hauled up a grade a mile long, with several curves and some 6 per cent grades. To complete the difficulties a move was necessary with one of the outfits. By bringing in an extra mixer the remainder of the equipment was moved 15 miles across country and some pavement was laid on the same day.

Another contractor finished 16 miles of pavement in 1922 at the rate of 714.5 ft. for every day worked. He worked 67 per cent of the time and yet made two long moves by rail during the season. This same contractor finished his last job by a continuous run of 20 calendar days at the rate of 920 feet per day, laying 18,406 ft. of pavement in this time. The working day of this outfit was 10 hr. long and this was seldom exceeded by more than a few minutes. Runs of 1,000 to 1,200 ft. are numerous and 800 ft. was the common thing with many outfits.

There can be no debate about the expensiveness of lost time on construction work. The engineering force on the job is there and cannot be used for any other useful purpose as a rule, during the idle times. No increase in the engineering personnel would ordinarily be required if the lost time were eliminated. Also the contractor in order to continue being a contractor must make a living from his business, and it is impossible to hoodwink ourselves by trying to believe that the cost of his lost time is not charged to the work.

It would seem to be a matter of common interest among all concerned to join forces and to whatever is possible to eliminate waste time. All would profit in the end· the engineer by reputatión for efficiency, the contractor by increased output, and the public by reduced costs. Even the machinery manufacturers and material men have an interest, in the increased demand for their products. These data and conclusions have the very common fault of being destructive rather than constructive. The writer has no solution to offer for the problem presented. In fact, it probably hsa no single solution. The betterment of the conditions noted will more likely come through the gradual whittling down of the delays at every point by the united efforts of all concerned.

The duty of the engineer in the matter seems clear. It will be his function to point the way, in-as-much as in his hands lie most of the facts and figures, or the opportunity to collect them. In this connection it is the desire of the writer to appeal to others more favorably situated than we are in Iowa, to keep similar records of lost time on highway work. Our program is small and our territory limited while by extending this process to other states soon a valuable mass of data would be on hand.

Current Events in the Field of Highway Engineering and Transport

ONTARIO GOOD ROADS ASSOCIATION HOLDS ANNUAL CONVENTION IN TORONTO

Delegates from all parts of Ontario assembled in Toronto in order to attend the annual convention of the Ontario Good Roads Association which opened on Thursday March 1. The feature of the first day's session was the discussion on county roads. Guy Marston, of Norfolk county, gave some interesting figures relative to the increased cost of maintaining highways, due to the increased number of automobiles. Since January, 1918, to December, 1922, the number of automobiles in Ontario has been increased by 234,172 cars. Estimating the average distance traveled in a year by each car as 2,000 miles it meant an increased mileage of 486,344,000 miles over Ontario's highways. In his own county 83 miles of road has been built at an average cost of $22,816.82 a mile. In 1909 a concrete road could be built at an average cost of $1.28 a square yard. At the present time a gravel road would cost the builder about $1.10 a square yarl.

L. N. LaPointe, of Prescott and Russel counties, told of the policy used there, that of putting a coat of oil and over a water-bound macadam surface. This, he said, meant a considerable cut in the cost of maintenance. His suggestion that the province assume the costs of county road maintenance caused considerable discussion.

Mayor C. A. Maguire of Toronto in a brief address said he was proud of the part that Toronto had taken in the building of highways but exception was taken to this by W. A. MacLean, F. H. Richardson and T. J. Mahoney. Mr. MacLean pointed out that while Toronto was contributing its $1,340,000, the townships had contributed $30,000,000 and the counties had contributed between forty and fifty millions in the same direction. Mr. Mahoney, felt that Toronto's policy in making such contributiins had been a far-sighted one which had worked out to the advantage of the city and not to the advantages of the suburban areas. For instance, Mr. Mahoney indicated that the city, by going into the suburban highway development scheme and by contributing thirty per cent, of the cost, had succeeded in getting improvements on roads which were later taken into the city limits. So, as Mr. Mahoney had it figured out, the city got its suburban roads built for thirty per cent of the cost, instead of one hundred per cent.

Mr. Richardson in support said that if Toronto went into the suburban roadway construction scheme on the same basis of assessment as the other municipalities, then the city wiuld be paying 75 per cent. of the cost instead of thirty. So far as the roadway from Toronto to Oshawa was concerned—that being the strip in which Mr. Richardson was most interested—the ex-warden felt that Toronto is escaping with the lightest of all burdens.

At the same time, there is a strong movement on foot to protest against the smaller cities paying anything toward the building of such roadways outside the city; for on the first day of the convention the representatives of several of the smaller cities held a little convention of their own and turned up at the main gathering with a resolution of protest. This was presented by Charles D. Campbell, city engineer of Belleville, who declared that he had the backing of the cities of Hamilton, Peterboro, Brantford, Belleville, Galt, Windsor, Owen Sound and Guelph, and whose resolution was to the effect that the smaller cities should not be asked to bear any share of the cost of building provincial highways outside of the cities. He further suggested that this whole financial burden should be taken over by the Provincial Government, and that, if the Government did not feel like assuming it, then it could ask the Federal Government to increase the subsidy to make allowance for that type if highway construction.

S. L. Squire, chairman of the executive of the Canadian Good Roads Association, presented many figures to show that the Federal Government should be more liberal in its contribution towards the construction of roadways within the various provinces. For instance, he pointed out that a large slice of the income of the Federal Government comes from duty on automobiles and their parts, and from taxes on various sorts. This, he estimated, would run around $20,000,000 a year, which was equal to the whole amount which the Federal Government is ready to spend on improving highways. Except for goid roads, there would not be the same demand for automobiles, and, accordingly, the revenue of the Dominion would fall off, so, it is the duty of the Federal officials to see that large grants are made to the provinces.

The growth of the Department of Highways was pointed out by Mr. MacLean, Deputy Minister, who showed that now the annual receipts of the Province from automobiles are in excess of the total income of Ontario at the time when the Good Roads Association was formed, so it was absolutely essential that a great deal of attention should be paid to this form of transportation. Much progress has been made in the provincial system, Mr. MacLean declared, and he was cinfident that the full 1,800 miles will shortly be in splendid shape. Up to date, approximately $25,000,000 has been spent on Ontario's highways of which amount the sum of $5,800,000 has ben contributed by the Dominion, and from five to six millions by the counties and cities, leaving a little more than half the total outlay to be raised by taxation.

At the closing session on Friday a resolution was adopted in favor of the

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CALIFORNIA COMPLETING MANY ASPHALTIC CONCRETE ROADS

The California Highway Commission has recently added a 9.52 mile section of completed highway to its system. The section, known as the Blackpoint Cut-off, lies between Ignacio and Fairville. About six miles of this roadway is across the marsh lands at the head of San Francisco Bay.

This roadway originally constructed in 1916 was a 7 ft. fill, 30 ft. wide at the base and 22 ft. wide at the top. The material, from which this fill was constructed, was dredged from the marsh and supplemented by a surface of gravel and clay obtained from cuts made on portions of the roadway on high ground.

On September 1st, 1921, a contract was awarded to the Grant Smith Company for paving this highway with a 3½ in. asphaltic concrete base and a 1½ in. asphaltic concrete surface 18 in. wide. The original fill over the marsh was widened 3 ft. on each side and additional material placed on the subgrade where settlement had occurred. The additional surfacing material required was as much as 6 in. in places but would average approximately 4 in.

Actual paving started May 18, 1922. For the last three months the average run has been 1,000 lineal feet of base 3½ in. thick per day. Approximately 80 per cent of the work was completed in the regular way but on the remainder of the job Galion rock spreaders were used and this innovation proved a move for efficiency and economy. Formerly eleven men were employed on the road to handle the output of one plant, but after the adoption of the spreader method nine men handled the output of two plants.

Black base pavement for road construction on unstable sub-grades and marsh lands has been laid in the Pacific Coast States since 1894, when the first black base pavement was constructed on Main street in Visalia, California, under heavy traffic, and is in excellent condition, and nothing has been necessary for maintenance.

Several counties in the state have taken this as their exclusive type for their paving program. Among these are Kings County, with 104 miles, and Fresno County with over 135 miles of this type. Butte County has voted a bond issue of $1,800,000 to be used in building asphaltic concrete, and Yolo County spent $1,000,000 in 1920 for the same purpose. Ventura County in 1920-1922 laid approximately 18 miles of black base.

Among the projects on which work has been going on in 1922 are the Mecca-Thermal section in Riverside County 7.8 miles in length, and the Lompoc Road, 28.5 miles long in Santa Barbara County.

Provincial Government taking over the Toronto-Hamilton Highway and completing the provincial highway from Windsor to the Quebec border. The delegates also went on record as being in favor of the principle of Federal aid to highways and eltension of time ti the provinces unable to take full advantage of their grants within the time limit. The following officers were elected: Honorary presidents, T. J. Mahoney, Hamilton, W. H. Brown, Chesley; president, John Currie, Middlesex; vice-presidents, Hon. George S. Henry and A. Rose, Brant; secretary-treasurer, S. L. Squire, Toronto. directors, Harry Bromgole, Elgin; Peter Ray, Wentworth, J. E. Jamieson, Simcoe; F. H. Richardson, Ontario; W. H. Nugent, Hastings; John Hanna, Addington, and F. A. Senecal, Prescott and Russell.

INDIANA TO OPEN BIDS FOR 35 MILES OF ROADS ON APRIL 10TH

The State Highway Commission of Indiana will open proposals on April 10 for paving approximately 35 miles of roads. At the same time bids will be received for a gravel base only on 7 miles, and for grading and structure under 20-ft. span only, on about 6 miles. The paving is divided into seven projects and is a part of the commission's program of hard surfacing for 1923.

All paving projects are on main thoroughfares. Two projects are on the Range line or Louisville road, south of Indianapolis; two on the Dixie Bee Line, one on the Lafayette pike just west of Indianapolis one closes the Reelesville gap on the National road, and one is one the Angola road. The paving projects are as follows:

Louisville road from Underwood to Marshfield Crossing, in Scott county, 7.37 miles.

Louisville road from South Branch to North Branch of Muscattatuck river, in Jackson county, 9.10 miles.

Dixie Bee Line from Farmersburg to 1½ miles south of Pimento in Vigo and Sullivan counties, 2.26 miles.

Dixie Bee Line from 1½ miles south of Pimento to Youngstown in Vigo county, 5.69 miles.

Lafayette Pike from Indianapolis to Salt Lake road in Marion conuty, 2.31 miles.

Angola road from Lagrange county line to 5 miles west of Angola, in Stuben county, 5.13 miles.

National Road, the Reelesville Cut-Off, in Putnam county, 1,558 miles.

Bids will be received for three types of pavement on these projects brick, bituminous concrete and concrete. The highway commission will provide the cement, Mr. Williams says.

At this time the commission is asking bids for a gravel base course only—grading and structures having been completed on the Tell City—English road from Tell City to Don Jaun, in Perry county, for 6.813 miles; also for grading and structures under 20-feet on the same road from Don Jaun to St. Croix for a distance of 5.571 miles.

ONTARIO ROAD SUPERINTENDENTS HOLD THREE DAY CONFERENCE

Under the auspices of the Ontario Department of Public Highways, the Ninth Annual Conference on Road Construction was held on Feb. 26-27 in the Assembly Room of the Highway Administration Building, Toronto.

The opening paper was read by Chas. Talbot, Middlesex county engineer, on the subject of "Motor Truck Haulage," in which he compared the costs of truck and team haulage in the country, on road construction work. Mr. Talbot claimed that the wages and hire paid by the counties to farmers working upon the roads was too low, and that trucks were in reality being used in competition with the farmers' teams, forcing the latter to work at a rate that was entirely unreasonable. The county councils should, he said, rather leave the trucks in the garage than use them in this manner, for the farmers already had sufficient difficulty in making ends meet. The policy would only drive them to the larger centres of population, where their labor was more remunerative. Mr. Talbot supported these opinions by figures. His views were by no means concurred in by all present and a lively discussion followed.

G. E. Stephenson, Bruce county engineer, started the afternon session with a paper on "Patrol Maintenance," and outlined the regulation for patrolmen in Bruce county.

"Road Accounting" was the subject of the next paper, by E. L. Miles, Victoria county engineer. In it he discussed the details of the system of ariving at the costs, both as the work progresses and of the finished work; the various methods employed to check all matter pertaining to the purchase and handing of supplies, questions of pay and instructions to foremen; and finally the preparation of the annual report. The paper covered the accounting end of road work very clearly and well and will prove or decided value to those looking for such information.

Tuesday's meeting was opened by F. J. Ure, engineer of Oxford county, who spoke on "Drainage," the paper being productive of some very interesting discussion. In the morning also, H. Irwin, district county engineer, gave a talk on "Township Road Organization," which elicited the warmest commendations of those present. In the afternoon, E. A. James, York county roads engineer, spoke on "Bituminous Concrete and Penetration Surface."

AMERICAN SOCIETY FOR TESTING MATERIALS PUBLISH PROCEEDINGS AND CUMULATIVE INDEX

The American Society for Testing Materials has just issued the proceedings of its Twenty-fifth Annual Meeting held at Atlantic City, New Jersey, last June from the 27th to the 30th. Due to the great amount of material to be presented this year's proceedings is issued in two parts. Part I contains the committee reports and new and revised Tentative Standards; and Part II the technical papers and discussion thereof. Part one contains 1024 pages and part two 592 pages. The Society has also published an index to Volumes XIII-XX of its proceedings which covers the activities of the organization from 1913 to 1920. The index contains 189 pages including preface and list of key words and may be obtained in cloth binding for $2.50 or in half-leather binding for 03.50.

PENNSYLVANIA BIDS ON 64 MILES OF HIGHWAY TO BE OPENED APRIL 3

The State Highway Department of Pennsylvania will open bids on April 3 for the construction of 74 miles of durable highway. There are 29 projects in [illegible] one are concerned. The project on which the cost will be met by the State is on Route No. 68, Indiana County, between Blairsville and Indiana, to complete a portion of the primary highway system authorized last year. The projects included in the letting of April 3 are as follows:

Beaver County—In Patterson and Chippewa Townships, on Route No. 204, 7,979 ft.

Butler County—In Fairview Township on Route No. 214, 11,322 ft.

Clarion County—In Washington Township, on Route No. 91, 12,698 ft.; in Washington Township, on Route No. 91, 5,766 ft.; in Edenburg Borough, on Route No. 218, 6,995 ft.; in Clarion Township and Clarion Borough, on Route No. 66, 12,867 ft.; in Sligo Borough, on Routes Nos. 214 and 311, 5,187 ft.; in Clarion and Monroe Townships, on Route No. 214, 14,636 ft.

Crawford County—In Richmond Township and Blooming Valley Borough, on Route No. 200, 34,462 ft.; in Oil Creek Township and Hydetown Borough, on Route No. 271, 22,485 ft.; in Spring Township and Springboro Borough, on Route No. 85, 33,532 ft.; in Springboro Borough, 6, 389 ft.

Indiana County—In White Township, on Route No. 68, 2,727 ft.

Lawrence County—In Scott and Plain Grove Townships, on Route No. 233, 18,189 ft.

Mercer County—In Stoneboro Borough, 3,275 ft.; Perry Township, 28,563 ft.

Monroe County—In Pocono and Paradise Townships, 7,051 ft.; in Smithfield Township, 10,952 ft.

Northampton County — In Hellertown Borough and Lower Saucon Township, 22,330 ft.; in North Catasauqua Borough, 3,844 ft.; in Wilson Borough, 4,834 ft.; in Bethlehem Township and Freemansburg Borough, 4,985 ft.; in Stockertown Borough and Balmer Township, 7,930 ft.; in Tatamy Borough and Palmer Township, 7,522 ft.

York County—In Winterstown Borough and North Hopewell Township, on Route No. 333, 25,234 ft.; in Hopewell Township, on Route No. 333, 14,787 ft.; in East Prospect Borough, Windsor and Lower Windsor Townships, on Route No. 332, 25,208 ft.; in Chanceford Township and Lower Chanceford Township, on Route No. 216, 26,252 ft.

In twelve instances alternate bids are asked for the construction of either bituminous surface course on a concrete foundation or one-course reinforced concrete.

MINNESOTA TAXPAYERS JAM CAPITOL TO URGE PASSAGE OF GOOD ROAD BILL

Big Gathering of Farmers and Businessmen Demands Favorable Action on Babcock Proposals

A big demonstration, virtually a good roads rally, at a public hearing in the Minnesota State Capitol before public highways committees of the Senate and House, showed how opposition has been magnified and went far to pave the way for favorable action on state highway bond legislation, according to reports from St. Paul.

Scores of farmers and businessmen from all parts of the State took advantage of an opportunity, they said, to finally put the Minnesota good roads movement "over the top." Public-spirited citizens identified with the Good Roads Amendment No. 1 campaign in almost every locality joined forces at the Capitol to do their bit toward insuring the biggest success of the highway program.

Charles M. Babcock, state highway commissioner, outlined the bond plan. He received a great ovation. The commissioner's statement and his prompt answer to every possible objection raised won an almost unanimous "vote of confidence." The large gathering went on record decisively in favor of the highway bond program when Commissioner Babcock presented the proposition. The commissioner had made it clear that the Minnesota plan is one first to improve and maintain the farm-to-market roads. He showed how all county and proposed state bonds with interest can be paid out in full in twenty years and made to give the use of more good roads every year under the bond plan.

The opposition was voiced mainly by a farmer-banker from a district in which the roads have been extensively improved by the use of about $500,000 of trunk highway funds. One member of the Legislature indicated that he might offer his objections later, and a few asked questions that showed they either lacked information or were misled on the bond plan. This diversion fanned up the enthusiasm of the hundreds of good road advocates that packed the house chamber and galleries and adjoining halls.

Commissioner Babcock gave positive assurance that the bond plan will mean the biggest success from the highway program. He showed how the local roads are being built rapidly and local taxes are decreasing and how provision for larger working capital now will mean the most effective and prompt results on the state highways. He referred to the responsibility of the Legislature to carry on the road program as demanded by the great majority and made easy by pending recommendations.

Almost every Senator and Representative present at the hearing was surrounded by citizens from his district bent on securing his vote for the bond bills. Many self-appointed delegates took pride in announcing that their members were supporting the bond measures. Others said their members were becoming convinced that the bond plan is favored by all who have obtained the facts and studied it and that the people of the State will be given the benefits of its adoption. Senate and House committees are expected to report out the bond bills soon, following the hearing given the individual citizens and representatives of farm bureau, commercial and other like organizations from every part of the State.

ROAD BUILDING IN WYOMING HAS RAPID GROWTH

The Department of Agriculture at Washington points to the State of Wyoming as an example of what may be accomplished through an energetic and well-directed road building policy. "The past seven years," says a statement emanating from the department, "have witnessed a period of great road development in the state of Wyoming. From 1914 to 1921 the total road mileage increased from 14,797 to 46,528. This is in strong contrast to the majority of states, which have made great progress in road improvement, but without any appreciable change in total mileage.

"During the seven-year period the mileage of improved roads in Wyoming has increased from 1724 to 6867 miles. The mileage of roads is classified as follows: Unimproved 39,373; graded and drained, 6715; gravel, chert, shale, 413; hard-surfaced, 27.

An analysis of the figures collected by the bureau shows that there is one-half mile of road per square mile of area; that the total annual road revenue is $55.32 per square mile, $116.25 per mile of road and $27.82 per capita.

"In 1921 the total road revenue, including federal aid funds, amounted to approximately $5,408,000. The expenditures were $4,725,000. During the year 1673 miles of improved road were completed."

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1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.
1 7x10 Lidgerwood DC DD hoist and boiler.
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24,000 ft. Lakewood 24 in. ga. 20 lb. portable track, 15 ft. sections, with turnouts complete.
50 Batch box cars and 30 cu. ft. batch boxes.
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4 6 ton, 24 in. ga Cummings locomotives.
2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.
1 Foote Paver, Shop No. 1484, self-propelling, steam driven, 2-bag batch; overhauled ready for work.
1 14-E Rex Paver, caterpillar traction.
1 No. 11 Koehring Paver, wheel traction.
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1 7 ton guy derrick, 70 ft. boom.
1 7 ton stiff leg derrick, 60 ft. boom.
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OFFICIAL PROPOSALS

STATE OF MARYLAND

STATE ROADS COMMISSION

Notice to Contractors

SEALED PROPOSALS for building six sections of State Highway, as follows:

GARRETT COUNTY—Cont. G-20-A—One section of state highway along Bear Creek between Friendsville and Kaese's Mill, a distance of 4.96 Miles—Concrete.

FREDERICK COUNTY—Cont.F-53—One section of state highway along the Urbana Pike between Urbana and the Montgomery County Line, for a distance of 2.0 miles—Concrete.

BALTIMORE CITY—Cont.BC-25-A—One section of state highway along Mount St. between Harlem Ave. — Riggs Ave. and between Laurens St. and North Ave. for a distance of 0.78 miles—Asphalt.

BALTIMORE COUNTY—Cont. B-53—One section of state highway along the Philadelphia Road between Whitemarsh and the Harford County Line, a distance of 4.5 miles—Concrete.

CAROLINE COUNTY—Cont. CO-33—One section of state highway between Goldsboro and Marydel, for a distance of 4.5 miles—Concrete.

WICOMICO COUNTY—Cont. WI-22—One section of state highway between Salisbury and Delmar for a distance of 2.8 miles—Concrete.

will be received by the State Roads Commission, at its offices, 601 Garrett Building. Baltimore, Maryland, until 12 M. on the 3rd day of April, 1923, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred ($500) Dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

BY ORDER of the State Roads Commission this 14th day of March, 1923.

JOHN N. MACKALL,
Chairman.

L. H. STEUART,
Secretary.

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GLUTRIN

Lincoln Highway

(*Continued from Page 109*)

during 1923 and 1924 are many of them rough and disagreeable to drive, but none of them are impassable or dangerous and all of them are financed.

California

California completed the grading of 18 miles on the Lincoln Way between Colfax and Auburn last year and accomplished about 2 miles of new paving work, including an overhead railroad crossing near Oakland. In 1923 the route from Auburn to Colfax will be paved with concrete. Some paving may also be done east of Placerville on the route south of Lake Tahoe. Both of these sections of the Lincoln Way are on the California Federal Aid System and both will ultimately be paved to the Nevada line. Both routes are kept in very fair condition, pending permanent improvement and no difficulties need be anticipated by the through tourist in the Sierras. New construction on the Lincoln Way cost California $68,529.50 last year and maintenance on 318 miles cost $187,612.83, or an average of $588.86 per mile.

1922 Improvement Table

Briefly summarized, the work accomplished on the Lincoln Way in 1922 is given in Table 1.

TABLE 1. CONSTRUCTION AND MAINTENANCE COSTS ON LINCOLN HIGHWAY IN 1922

State	Mileage	New Construc'n	Maintenance
New Jersey ...	5.61	$1,160,823.74	$125,395.80
Pennsylvania ..	7.24	439,033.00	567,955.63
Ohio	9.13	372,718.49	40,430.00
Indiana	25.03	766,000.00	89,790.73
Illinois	2.53	70,658.62	33,000.00
Iowa	49.80	702,674.00	120,088.00
Nebraska	69.60	527,000.00	(est)100,000.00
Wyoming	34.00	135,433.12	77,860.00
Utah	None	None	(est) 5,000.00
Nevada	48.00	435,171.23	20,993.40
California	2.50	68,529.51	187,612.83
	243.44	$4,678,041.71	$1,368,126.39

Total Expended on Lincoln Way in 1922...	$6,046,168.10
Average Cost per mile of new construction.	20,000.00

What kind of roads did the state build with that over four and one-half million dollars spent last year on the Lincoln Way? The following briefly indicates what the money invested accomplished:

Concrete	56.91 miles
Brick	15.13 miles
Gravel	144.00 miles
Permanent Earth Grade.................	27.40 miles
	243.44 miles

Through Traffic Will Be Heavy This Year

Without a doubt the traffic of 1923 on the Lincoln Way will break all former records. Even now hundreds are beginning to plan trips to the National Parks and other points of interest in that great playground of America between the Rockies and the Sierras. What has $47,000,000 worth of work done to the Lincoln Highway since 1913? Table 2 gives the answer. It shows the mileage of each type of improvement now existing on the Lincoln Highway. The natural earth and gravel are, of course, largely west of Salt Lake City. After June 1st, the 2450 miles between New York City and Salt Lake City will be very largely in boulevard condition except in wet weather. Little wet weather will be encountered along the route between June 15th and October 15th.

TABLE 2. TYPES OF ROAD CONSTRUCTION ON THE LINCOLN HIGHWAY, FEBRUARY 1, 1923

Concrete	578.66
Brick	128.76
Bituminous Macadam	327.80
Macadam	287.10
Graded Gravel	1,189.22
Natural Gravel	62.10
Graded Earth	404.39
Natural Earth	108.60
Paved City Streets..............................	218.50
	3,305.13

Yes, indeed, the well-marked, highly improved Lincoln Highway of 1923 is a very different route than the one followed by the aid of a compass in 1913.

Highway Transport and National Defense

(*Continued from page 111*)

bridges and placing earth roads in passable condition for the artillery. Along that section of the coast it would have been absolutely impossible to have sent an adequate force to the coast in time to repel a strong land combat by the enemy.

Protection from Internal Disorders

I have said that national defense involves not only protection against invasion from the outside, but also the preservation of our social and economic life from internal disorders. The subject of internal disorders is an unpleasant one, but like the nettle, a gingerly manner of handling only results in stings and wounds, while a firm grasp produces prompt destruction with little or no injury to the party acting. It is believed, therefore, that it is not only wise to make proper preparations against possible internal disorder, but failure to do so would be neglect of an evident duty.

Judging from history, internal disorders which finally result in serious opposition to the Government are ordinarily of gradual growth, depending, however, largely on the perfection of the organization of the elements of disorder and likewise on the organization and preparation of the elements making for order and good government. Ordinarily, these disturbances start with sporadic outbreaks which, if promptly handled, disappear immediately. If not promptly handled such sporadic outbreaks grow and combine until strong enough, in certain territory, to gain control of means of communication, thus having in their power the lives and property of the inhabitants, whose normal supply of food, clothing and other necessities of life is thus interrupted. One of the first duties of the government is, therefore, to maintain control of the ordinary means of communication or to previously make provisions so that if some of those means are lost others by which the distribution of the things important and vital for a continuance of social life can be promptly put into operation.

GOOD ROADS

Title Reg. U. S. Pat, Off.

The Journal of Highway Engineering and Transportation

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIV MARCH 28, 1923 No. 13

What Experimental Road Testing Has Taught Us

Some Conclusions to be Drawn from the Bates Road Tests

By CLIFFORD OLDER

Chief Highway Engineer, Illinois

MUCH has been said and published in regard to the construction and testing of the Illinois experimental road. However, it may not be amiss to say again that this large undertaking was based upon the fact that it was deemed wise to design the best road possible upon which to expend the large sums of money which Illinois had available at the beginning of 1920—The Sixty Million Dollar Road Bond Issue, which the people of Illinois had voted in November, 1918, and the Federal Aid appropriations. When the State Road Bond Issue campaign was under way, the state highway officials were giving considerable thought to the designing of pavements that would sustain the heavy truck and rural traffic which such pavements would be called upon to carry. Therefore when this large sum for a road construction program was made available, it was the judgment of the state officials that a test road should be built which would give us definite knowledge of the behavior of certain pavements under heavy truck traffic and rural conditions. The turning over of surplus trucks to the states by the War Department afforded the opportunity of making traffic tests as soon as the experimental road could be constructed. It was started in 1920 and completed during the summer of 1921. Our records indicate that its cost to date is approximately $226,000; and this has already been amply repaid in the saving of many thousands of dollars to the tax payers of Illinois because of the knowledge gained by our engineers in the design of cheaper and better pavements.

At the 1922 annual meeting of the American Road Builders Association the writer had the pleasure of presenting a paper which contained a summary of the results of the scientific research work that had been carried forward for more than a year on the Bates Road. In March, 1922, the tests by truck traffic was started; and continued until September. Upon the completion of each increment of load, up to the Illinois legal limit, new bulletins were issued by the Department. The last bulletin contains a summary of the damage done to each section and group of sections. Studies made since the issuance of that bulletin are set forth in this paper.

Load Control of First Importance

Two outstanding conclusions may safely be drawn from the general behavior of the Bates Road, even were they not supported by other evidence. First, the load carrying capacity of any design of rigid pavement slab is in direct proportion to the ability of its weakest part to resist bending stresses. Many, or all, of us have built concrete and other rigid pavements 6 in. thick at the edge or perhaps even less. The Bates Road data indicates clearly that under fixed conditions pavements of a definite thickness will carry certain wheel loads indefinitely. The passage of numbers of somewhat heavier loads will result in numerous corner breaks involving heavy maintenance expense. Still heavier wheel loads may quickly result in complete destruction.

The carrying capacity and therefore the useful life of a rigid pavement being thus dependent upon the magnitude of the wheel loads that cause breaking stresses, we cannot hope to construct pavements that may be maintained economically, or that may not be utterly destroyed in a few months or years unless wheel loads are rigidly controlled. It is not reasonable to expect local authorities to enforce load regulations. It must be done by a state police force; and any state that does not provide for truck load control faces the early destruction of its paved roads unless truck manufacturers and owners have a radical change of heart.

The second general conclusion is of a different character. Rigid pavements having a uniform thickness or

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Paper presented at annual convention of American Road Buliders Association, Chicago, Jan., 1923.

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edges thinner than the center are greatly unbalanced in strength and will fail along the edges long before wheel loads are reached that would cause the destruction of other portions of the slab. Although 50 of the original 63 sections of the Bates Road were either partially or completely destroyed, not one case of serious partial or complete destruction of a rigid section occurred that was not directly due to the lengthening and widening of one or more small broken corner areas.

The comparative absence of destruction along the north edge of the road where the wheels, except during the first and a part of the second load increments, traveled 3 ft. from the edge is striking. In every case where the entire width of the pavement or areas along the north side are now destroyed, the damage resulted as progressive failure from the broken south side corners, or north side corners broken by the first or early part of the second increments. There is much evidence to support the belief that had all of the traffic been not closer than 3 ft. to either edge even the 4 in. slabs would still be intact. Increasing the edge strength of pavements of ordinary width should therefore be of first importance in design.

Richness of Mix

The behavior of the various sections having concrete bases varying in the richness of mix furnishes food for serious thought. Two different mixes were used—one a 1-2-3½ mix and the other a 1-3-5 mix. In both cases the same aggregates were used. The ratio of sand to stone is practically the same for both mixes, being .60 for the 1-3-5 mix, and 0.57 for the 1-2-3½ mix. Seven sections ranging in thickness from 3 in. to 6 in. and aggregating 1375 ft. in length, were laid on the lean base. A 1-2-3½ base mix section, having the same base thickness and the same thickness and type of wearing surface, was laid to compare with each of the seven.

While most of the engineers, who were in constant touch with the test during its progress, believe they can trace a showing in favor of the rich mix, yet the difference is by no means marked. It is certain that the difference is much less than might be expected from a comparison of the compressive strength of the 6 in. by 12 in. test cylinders cast as the bases were poured. The 1-2-3½ cylinders averaged 4266 lb. per sq. in. while the 1-3-5 cylinders averaged 3378 lb. per sq. in. at the same age, or 79 per cent of the former. The results of the modulus of rupture tests, however, are a little more in keeping as for the rich mix they averaged 720 lb. per sq. in., and for the lean mix 633 lb. per sq. in., or 83 per cent of the strength of the rich mix. Prof. Abrams, in his Bulletin No. 11, as a result of many tests, shows that the modulus of rupture of concrete is much less sensitive to changes in the richness of mix or water ratio than compressive strength. In the light of these considerations and the Bates Road data, leaner mixes with increased thickness to compensate for strength loss may be an economic development under certain conditions.

Brick Wearing Surfaces with Bituminous Joint Filler on Waterbound Macadam Bases

Recent studies of the various sections grouped by types have developed some interesting features. Of brick there were five sections, having an aggregate length of 600 ft., of which 400 ft. consisted of 3 in. and 4 in. lug and lugless brick with bituminous joint filler, 2 in. sand cushion, 4 in. macadam base, and 200 ft. consisted of 3 in. and 4 in. lug and lugless brick, bituminous joint filler, 1 in. and 2 in. mastic cushion, 8 in.—2 course waterbound macadam base.

A series of cross sections taken at the same point across one of the sections having a 4 in. waterbound macadam base at different times, as the loading progressed showed that the destruction of this section was simply a matter of rutting in the wheel tracks which progressed to such an extent under the second increment that all of these sections were completely destroyed and unfit for traffic. A series of cross sections taken at different times at a given point on one of the section having an 8 in. 2 course waterbound macadam base was similar to others taken on the heavy macadam base, brick-top sections. While the heavier base sections stood up a little better than those having the 4 in. base, yet the difference is not marked and they had become so badly rutted under the second increment of loading that they could not be considered as representing serviceable pavements for such traffic loads.

Asphaltic Concrete on Waterbound Macadam Bases

There were six sections of this type, each 200 ft. long, aggregating a total length of 1200 ft. A 2 in. Topeka mix top was used on five of these sections, having bases as follows:

4 in. waterbound macadam.
4 in. compacted novaculite gravel.
6 in. waterbound macadam.
8 in. 2 course waterbound macadam.
10 in. 2 course waterbound macadam

One section was provided with a 3 in. Topeka top consisting of 1½ in. binder course, 1½ in. Topeka wearing surface on a 5 in. 1 course waterbound macadam base.

The section having the 4 in. Novavculite base was utterly destroyed under the first increment of loading. The section having the 4 in. waterbound macadam base was seriously damaged by the same increment; but as far as further service is concerned it actually remained in better condition than the Novaculite base section; and did not reach a condition which would render it unserviceable as a traffic road until the second increment.

It is agreed by the observers that the damage to each of these sections reached a point where it would be unfit for traffic service, and the maintenance expense would be exorbitant, under the increments shown in Table 1.

TABLE 1. TOPEKA TOP ON MACADAM BASE

Total Thickness in	2 in. Topeka Section	Increment.
6	10	1
6	11	1
8	9	3
10	7	2
12	6	3

From this it may readily be seen that as far as this test is concerned there appears no consistent relation between load carrying capacity and thickness of base. The section having the heavy top stood up best of all; however, the adjacent section having the same total thickness but a 2 in. top while it did not stand up quite as well, behaved better than those sections having thicker bases. This fact might indicate that some factor other than that of having a heavier top accounted for the stability of the 3 in. top section.

The greatest care possible was used in building the waterbound macadam bases for both the brick top and the asphaltic concrete top sections. The same care was used in preparing the subgrade; and practically all visitors agree that the soil and subgrade condition was as nearly uniform as ever occurs. The erratic behavior of the sections of both of these types would then lead to the conclusion that some element affecting the original construction other than uniformity of subgrade oil or thickness of base is of greater importance than either of these items, at least when such types of construction are built new on original subgrade soil.

As an illustration of this possibility, it was found in making bearing capacity tests of all parts of the subgrade preliminary to laying pavement that the moisture content of the subgrade soil was of extreme importance. Due to changing moisture content, the supporting capacity of the soil varied between wide limits at different times of the day as the soil dried out under the sun's rays. It seems quite possible that the original degree of base compaction, or keying with a given amount of rolling, might be dependent upon this factor. Such a condition of course would constantly apply in all sections of the country where rainfalls are frequent.

Whether it is significant or not, it is of interest to note that in both the brick and asphalt top sections the two course bases did not stand up as well as the somewhat thinner single course bases having the same surfaces.

In Table 2 all of the sections of this type are listed; and the increment of load indicated under which each section is considered to have developed critical failure.

TABLE 2. TOPEKA TOP ON CONCRETE BASE

Base	Base Mix 1-3-5				Base Mix 1-2-3½			
Thickness in.	2-in. Sec.	Topeka Incr.	3-in. Sec.	Topeka Incr.	2-in. Sec.	Topeka Incr.	3-in. Sec.	Topeka Increm't
4	12A	4	13	4	14	4(2)	15	4
5	16	5			17	6	18	(4)
6	19	6			20	6		
7					21	(4)		
8							22	

In the case of Sections 14, 18 and 21, where the increment listed as causing the critical failure is not the same as the increment causing the first corner break, it should be noted that in making these changes all circumstances surrounding the initial corner break of each section was carefully weighed by four members of the Department who were constantly in close touch with the progress of the traffic tests.

The changes made in Table 2 as well as in subsequent tables, are in most cases quite obvious from a careful study of the various News Bulletins issued by the Department from time to time, and the diagrams accompanying the same. It may be said that these evaluations were made and the tables prepared before any of the diagrams were plotted. Most of these changes are plainly fully justified; a few may involve some doubt. The average

(*Continued on Page 120*)

The Relation of Adequate Highway Transport Facilities to National Defense

By MAJOR GENERAL LANSING H. BEACH

Chief of Engineers, U. S. A.

(*Continued from March 21 Issue*)

The Motor Transport Section of the Army has worked out a method of distribution under which, in case of emergency, all motor transportation within any particular section involved can be promptly mobilized and placed into service. Motor transportation will be, however, of little avail if the roads which must be used are either non-existent or in such condition that they are not serviceable. It is here that the local communities are directly involved, and it should be impressed upon those who are influential members of such communities that good roads to their particular sections, while not necessarily meaning avoidance of internal disorders, may mean, in case such disorders do arise, that they and their families will not be subjected to excessive suffering and hardship. The roads can not act as preventatives, but they can serve as palliatives or as remedies when once the disorders have broken out.

Department Interest More Than Academic

I have discussed the general relationship between highways and military operations and the essential need for this means of communication in national defense. I wish, in conclusion, to state briefly just what the duties of the War Department are in this matter and to explain how the Bureau of Public Roads is cooperating so that highways built under Federal aid may, in so far as conditions permit, be of assistance in military operations.

The existing Act under which Federal aid is given to the development of highways is based on the power granted to the Congress of the United States by the Constitution "to establish Post Offices and Post Roads." Nothing is said in the Act in regard to the relation of highways to national defense and the only reference to this matter that I can find in any congressional legislation is contained in the Act of August 29, 1916, which establishes the Council of National Defense. In that Act it is made the duty of that council among other matters to "supervise and direct investigations and to make recommendations to the President and the heads of Executive Departments as to the location of railroads with reference to the frontier of the United States so as to render possible expeditious concentration of troops and supplies to points of defense; the coordination of military, industrial and commercial purposes in the location of extensive highways and branch lines of railroads." The Council of National Defense, however, no longer exists.

Importance of Departmental Cooperation

Recognizing that under existing laws the only agency through which the War Department can influence and give proper direction to the development of highways to meet military purposes is the Bureau of Public Roads of the Department of Agriculture, the Secretary of War early in 1919 arranged with the Secretary of Agriculture that the two departments through the General Staff of the War Department and the Bureau of Public Roads, respectively, should study the question of the relationship between highways as used for the purposes contemplated by the Federal Aid Act and the use of highways for military purposes. After a thorough discussion of the suject, the two Departments agreed on the following basic points:

(a) That roads which must be constructed for commerce and national development will, in general, be identical with those required for military purposes.

(b) That roads which serve mainly military purposes are comparatively few in number and such as are required to serve the local needs of military posts, etc., should be taken care of by the War Department.

(c) The Bureau of Public Roads will keep the War Department fully informed by maps and other data of the latest available state roads, and will give such assistance through its local district organizations to the Corps Area Commanders under the War Department as may be practicable.

(d) The Chief of the Bureau of Public Roads will confer with the Chief of Engineers as to the classification of roads for military purposes and will cooperate with him in determining types of construction, and loadings of culverts, bridges, etc., to meet military requirements.

(e) Based on a study of the road system and military needs, the War Department will furnish the Department of Agriculture a map showing the general system of roads which it is desired to have developed for military purposes, these roads merely indicating termini and general direction, the actual location being determined by local conditions and needs.

In accordance with the agreement just indicated, the War Department has prepared an outline of a system of the roads covering the entire country which it believes should be developed for military purposes. These roads are indicated as of first, second, and third priority. In general, these roads are laid out to fulfil the needs of the defense of our coasts and land frontiers according to the motor transport plans already adopted. The road outline plan also involves a connection between the areas subject to invasion and our centers of production and storage and with our industrial centers. It is noted that in preparing this road scheme, a transcontinental road or series of roads, which merely crosses the continent was considered to be of little military value, but what is desired, and what forms the basis of the proposed system, is a series of roads connecting all important depots and industrial centers, which, however, though incidentally, will furnish a transcontinental route. The proposals of the War Department have met with hearty response and cooperation between the two departments will gradually result not only in a system of highways and roads suitable for commercial development, but also one which will be of inestimable value in case of emergency requiring the use of military force.

It is our duty to prepare for this conflict so that if it does come we will be found ready. It i s also possible that by the mere act of preparation we may ward off wars or prevent disorders which otherwise might occur. Among the weapons, which, God grant, may never have to be used for this purpose, but without which we would be in a sad plight, are ways of communication, including railways, waterways, and that in which you are mainly interested at the present time, highways.

Experimental Road Testing

(*Continued From Page* 119)

modulus of rupture of the concrete base of all of these sections, determined as above indicated for both the lean and rich mixes, was 706 lb. per sq. in.

It should be said, in connection with this group of sections, that while the critical load supporting capacity apparently coincides with the strength of the base, with little or no allowance for the top, yet critical corner failures were not in many cases followed by immediate breaking down of large areas, as was the case in some of the other rigid types. However, it is believed that pavements of this type should be designed on the basis of the base thickness alone, being sufficient to resist all corner breaks. Although such breaks might not be followed by further extensive destruction, nevertheless serious items of maintenance costs would be involved. Loads that cause one normal break per 200 ft. as represented by a test section might be expected to cause about 25 such breaks per mile of pavement of the same design. The ability of this type to resist progressive destruction can hardly be considered of great weight as if this feature is to be of value it must be assumed that the load we are designing for will be exceeded.

TABLE 3. BRICK—BITUMINOUS FILLER—CONCRETE BASE SERIES

	Base Mix 1-3-5				Base Mix 1-2-3½			
	3-in. Brick		4-in. Brick		3-in. Brick		4-in. Brick	
Base Thickness	Sec.	Inc.	Sec.	Inc.	Sec.	Inc.	Sec.	Inc.
3½″	32A)	3 (2)			30	[illegible]		
	32B)	(2)						
4″							26A)	3 (2)
							26B)	(6)
4½″					27)	4 (2)		
					28)	(3)		
					31*	4 (2)		
5½″					24	6		
					25**‡			
6½″					23A)			
					23B)	6		

Note:—Figures in parentheses show increment causing actual first break when other than as evaluated. Bracketed sections evaluated as one section.

*3½″ base ¾″ sand cement bed.

** Mastic in place of sand cushion.

‡ No corner break under any increment.

Table 3 indicates the evaluated critical load for all sections of this type. Inasmuch as the only difference between certain of these sections is in the type of brick used and inasmuch as the artificially opened joint occurred in each case in the section surfaced with lug brick, all sections differing only in the type of brick used in the wearing surface have been regarded as a single section. A considerable number of adjustments seemed justifiable in the case of this type; and attention therefore is particularly invited to a study of the various Bates Road News Bulletins and diagrams accompanying the same.

Monolithic Brick Series

Table 4 shows the increment causing critical breaks in all of the monolithic brick sections:

A review of the history of the behavior of these sections led to assigning a value for the critical load increment other than that causing the first break in one instance only. The table it will be noted shows not only the total thickness is used as a basis of breaking strength the strength basis of this type of pavement, but also the thickness of the brick course; the concrete base course;

and an equivalent thickness. It is to be noted that if the total thickness is used as a basis of breaking strength it does not at all correspond with the theoretical breaking load. In this connection the behavior of all of the sections of this type previous to and during the traffic tests is of much interest. Prior to the truck loading it was observed that at many points the brick surface had separated distinctly from the base, as determined by sounding, and by actual observation along the edges of the pavement. By observing the edges of the slab, when the traffic tests were started, it was noted that at many critical points the base and the brick top acted as independent units. In the case of each section of this type, the first increment of loading caused at one or more spots a cracking of the grout filler between the individual bricks. Although this happened on monolithic sections having a base only 2 in. thick, yet it is a matter of common observation that the base did not immediately fail in all such cases. It should be taken into consideration, however, that the average air temperature was high, and, except where artificial joints were cut, the wearing surface, and perhaps also the base, was under compression due to temperature expansion.

TABLE 4. MONOLITHIC BRICK SERIES

Total Thickness, in.	Brick Thickness, in.	Base Thickness, in.	Equivalent 2-Layer Thickness, in.	Base Sec.	Mix 1-3-5 Inc.	Base Sec.	Mix 1-2-3½ Inc.
5	3	2	3.6			33	1
5¾	3	*2.75	4.0			34A	3
6	3	3	4.24	36	3	37	3
6	4	2	4.5			35	3
7	4	3	5.0			38	4 (5)
8	4	4	5.7	39	4		

Figures in parentheses show increment causing actual first bresak when other than as evaluated.
*—2 in. base, ¾ in. sand cement bed.

The figures in the column in Table 4 headed "Equivalent Two Layer Thickness" were obtained by computing the thickness of a slab, having the same modulus of rupture as that of the concrete base, and a breaking strength equal to that of the base plus that of the brick layer. In determining the strength of the brick layer, it was assumed that the grout filler would have the same modulus of rupture as that of the concrete base.

Concrete Series

Table 5 shows the evaluated critical breaking load for all concrete sections. The evaluated critical load for only 6 of the 24 sections is other than the increment which actually caused the first break. The average modulus of rupture of the test specimens, representing the sections containing calcium chloride and cemite cement, was distinctly lower than that of the other sections. Further, the 5 in. section in which gravel concrete was used was obviously inferior. Some of the sections having both transverse and longitudinal joints with marginal reinforcing steel also showed somewhat erratic behavior. Most of them showed comparatively high strength, although one 6 in. section of this type fell considerably below the average. In none of these sections occur special features such as longitudinal or transverse joints, reinforcement or chemical additions, except as above indicated and the actual and theoretical breaking loads show a rather surprising conformity.

The fatigue tests which have been carried on by the Illinois Division of Highways for about 18 months indicate conclusively that concrete may resist bending loads indefinitely if such loads do not cause fibre stresses in excess of ½ of the modulus of rupture of the concrete. Inasmuch as it was impossible to operate the trucks a sufficient number of trips for each increment to cause fatigue, the plotted points in all diagrams without doubt are but little affected by fatigue breakage. The laboratory tests show that where the loads applied, produced a fibre stress of from 5 to 10 per cent in excess of ½ of the modulus of rupture, fatigue may not follow for from 5,000 to 40,000 repetitions. Loads which produce fibre stresses in excess of 60 per cent of the modulus of rupture are usually followed by breakage after a comparatively few repetitions. It seems safe therefore to conclude that had the number of applications of each increment been much greater—say 30,000 to 40,000—we would have the breaking load points falling, in the main, between the curve passing through points representing a fibre stress of 703 and that representing a fibre stress of 351.

Safeguards for Existing Pavements

Many miles of pavement now in service are directly comparable with the Bates Road sections and it is therefore not unreasonable to expect such pavements to show corner breakage when the load thickness relationship here shown prevails. Further the behavior of the test sections show that loads in excess of the critical load, as determined by the theoretical curve, are almost sure quickly to cause extremely serious progressive destruction.

It would seem difficult to eliminate the danger entirely. It is suggested that shoulders of gravel, macadam, concrete or other material which could be constantly maintained, preferably slightly higher than the permanent edge, would help. Such shoulders would ordinarily prevent wheel loads from being applied to the extreme edges of the slab and thus tend to reduce bending stresses. Center traffic lines also help because where such lines exist drivers concern themselves only with keeping their vehicles on the proper side of the line. Without such lines they crowd to the outer edge of the pavement in order to make sure to clear passing vehicles. Heavy tri-

(*Continued on page* 124)

TABLE 5. CONCRETE SERIES

Total Thick-[illegible]	Plain Concrete Sec.	Plain Concrete Incr.	Plain Concrete 25 ft. x 9 ft. Sections No Steel Sec.	Plain Concrete 25 ft. x 9 ft. Sections No Steel Incr.	25 ft. x 9 ft. 25 ft. x 18 ft. Sections Marginal Steel Sec.	25 ft. x 9 ft. 25 ft. x 18 ft. Sections Marginal Steel Incr.	Cemite Cement; Calcium Chloride; Hydrated Lime Sec.	Cemite Cement; Calcium Chloride; Hydrated Lime Incr.	Illinois 1921 Standard Type Sec.	Illinois 1921 Standard Type Incr.	Wire Mesh Sec.	Wire Mesh Incr.
4″	61B	3					cc 59	1	62	3 (2)		
							C1 60	3				
							H 61A	2				
5″	54	4			a 48*		C1 56	3			53	5
	G 55	2			b 49*	(6)						
					c 50	6(5)	cc 57	3				
6″	52	6			a 45	5						
					b 46*	(6)					51	6
					c 47*							
7″	44	(5)	43	*					63A			
									63B			
8″	42		41	*								
9″	40											

Note:—Figures in parentheses show increment causing actual first break when other than as evaluated.
G —Gravel concrete section.
cc —Cemite cement sections.
C1—Calcium chloride sections.
H —Hydrated lime "
a —25 ft. x 9 ft. sections 25 ft. x 9 ft. marginal reinforcement.
b —25 ft. x 9 ft. sections 25 ft. x 18 ft. marginal reinforcement.
c —25 ft. x18 ft. sections 25 ft. x 18 ft. marginal reinforcement.
* —No corner break considered critical under any increment.

Current Events in the Field of Highway Engineering and Transport

WEST VIRGINIA ROADBUILDERS FORM ORGANIZATION

The Associated West Virginia Highway Contractors was formed at a meeting on January 29th, 1923 at Charlestown, W. Va. There are 34 charter members, all representative contractors doing highway construction work in West Virginia. The meeting was enthusiastic and showed the deep interest felt by all the members in the proposed movement.

General offices in charge of a secretary will soon be opened in Charleston.

IOWA MAKING RAPID PROGRESS IN HIGHWAY DEVELOPMENT

The progress which Iowa is making in road development is evidenced by a recent tabulation showing the condition of the State's primary road system. The total mileage in the primary system is 6615.3. Of this, there were on Jan. 1 2961.8 mi. of earth roads, 1761.1 mi. of permanently graded roads, 1558 mi. of gravel roads and 334.4 mi. of paved roads. This shows that now 28 per cent of the system is surfaced with graveled or paved roads and approximately 55 per cent, including the paved and gravel sections, are now graded.

NEW HIGHWAY PROPOSED BETWEEN MAINE AND QUEBEC

Construction of the International Arnold Trail, which will connect the Rangely Lakes region with Canada by means of a highway opening up one of the finest scenic routes in New England has been approved by the Franklin County Commissioner. It will unite and develop two important sections of Maine and the province of Quebec, and furnish a direct route to the Seaboard.

The proposed road will extend from the state highway in Eustis to the border a distance of twenty-two miles, where it will join a three mile section of the Canadian highway to be built from Woburn, a few miles below Lake Megantic and the C. P. R. which crosses Maine.

NEW JERSEY ROAD BUILDING PROGRAM INCREASES PAVING SAND PRODUCTION

The great road building program which New Jersey has been carrying on for the past two years is reflected in the figures for the production of sand and gravel in the state during 1921 which have just been tabulated by Assistant State Geologist M. W. Twitchell. These are gathered by the Department of Conservation and Development in co-operation with the U. S. Geological Survey.

Although the total production and value of all sands and gravels were lower than those of several preceding years, paving, or road making, sand made an increase of 12 per cent in production and 5 per cent in value over 1920, the previous high year. Gravel used in highway construction also showed an advance. The largest share of these New Jersey products are used within the state.

A total of 3.568,780 short tons of sand and gravel, were produced in New Jersey last year, valued at $2,436,298. The corresponding figures for 1920 were 4,616,444 short tons valued at $4,330,844. Sand and gravel production is one of the leading mining industries of the state and is the most widely distributed. Pits are found in 16 out of the 21 counties from Sussex to Cape May. Burlington, Cumberland and Middlesex counties lead in the number of producers in the order named.

In 1921 figures for the divisions within the group are as follows: building sand (concrete and mortar) 1,426,327 short tons valued at $627,232; paving or road making, sand, 632,368 short tons valued at $345,376; molding sand, 241,587 short tons valued at $306,209; glass sand, 103,694 short tons valued at $196,814; cutting and grinding and glass sand, 49,479 short tons valued at $132,351; engine sand 49,107 short tons valued at $27,612; other sands, 50,729 short tons valued at $98,897; and gravel, 1,015,489 short tons valued at $701,807.

WESTERN ONTARIO TO MARK PROVINCIAL HIGHWAY

Chambers of Commerce of cities on the provincial highway in Western Ontario have decided on the marking of this highway. It will be two narrow white bands with a wide red band in the centre of poles placed at stragetic points. On the Brant section of the highway the red and white bands will be surmounted by a profile of Captain Joseph Brant with the words, "Brant Highway."

To preserve some of the historical associations connected with the various parts of the province through which the highway runs, names have been adopted as follows:

Niagara Falls to Hamilton—Queenston Highway, Hamilton through Brantford to Paris—Brant Highway. Paris to London—Governor's Road, or highway. London to Windsor—Longwood's Road or highway.

MANITOBA GOOD ROADS ASS'N ELECTS NEW OFFICERS

At a meeting of the Manitoba Good Roads Association held recently in Winnipeg, S. R. Henderson, of East Kildonan, was elected president, John Haddow was re-elected to the vice-presidency and G. F. Bentley secretary. The principle of obtaining government control of trunk highways was discussed at length and will be urged upon the Cabinet at an early date. It was also decided to approach the government for a grant towards the annual log dragging competition to be held in the different municipalities. A resolution was passed endorsing the Canadian Good Roads' Association movement in favor of extending the time for the federal road grant.

PORTLAND CEMENT ASS'N OPENS NEW OFFICE

The Portland Cement Association has opened offices in New Orleans, with John E. Tate as district engineer. Mr. Tate will have supervision of Louisiana and Mississippi. Mr. Tate comes from the Atlanta office of the association, where he was field engineer. Prior to this he was resident engineer of the Maryland State Roads Commission and served also with the Delaware State Highway Department as assistant engineer.

INDIANA ROAD CONSTRUCTION OVER 100 MILES DURING 1922

During 1922 the Indiana State Highway Commission contracted for 110.78 miles of concrete road and 7.07 miles of brick pavement according to a recent statement by Carl Gray, chief engineer. Of this mileage there was completed up to the close of the fiscal year, September 30, 63.43 miles of concrete and 3.52 miles of base for brick and 0.17 mile of brick pavement. Carried over from 1921 were contracts for 17.02 miles of concrete and 34.64 miles of grading and structure work. The commission desires to contract for 160 miles of hard pavement in 1923, approximately one-third of which has already been let. In its contracts the commission insists on storage of considerable material before starting work for the purpose of continuing operations in case of railroad congestion.

JAPAN BUILDING CONCRETE ROADS

Hakodate is the leading city in the northernmost island of Japan and heretofore has had unsatisfactory highways. A scheme has just been developed, involving an expenditure in excess of $2,000,000, under which it is proposed to pave about 1,200,000 sq. yds. of street with concrete, 7 to 8 in. thick. It is anticipated that this road improvement scheme will require a few years for completion, but it is interesting to note that, in common with a number of the other more important cities in Japan, definite steps are to be taken for the improvement of the roads.

MOTOR HIGHWAY TO BE BUILT IN ITALY

Work is in progress on a special motor highway connecting Milan, Italy, with the lakes that lie within a radius of 50 kilometers of that city. A concession has been granted for building and operating the road through private subscriptions and municipal subsidies. A toll system later will provide maintenance. It is estimated that the total cost will be about 60,000,000 lire (1 lire=$0.0486 January 9).

Motor vehicles in this country carry six times as many passengers as the railroads. They also carry 1,400,000,000 tons of freight, or about 80 per cent of the railroads annual tonnage.

PIERCE-ARROW SALES INCREASE 228 PER CENT

Sales of Pierce-Arrow passenger cars and trucks to date this year are 228 per cent greater than the total sales during the corresponding period a year ago, according to an announcement made by The Pierce-Arrow Motor Car Company.

"If the present demand in maintained—and there is no indication of any letup—the sales figures for 1923 will surpass that of any year since the first Pierce-Arrow was produced, 22 years ago," said Myron E. Forbes, president of the company.

"The comeback in motor truck sales is due to the revived need for the more modern types of trucks. The increased commercial and industrial activity of recent months has resulted in greatly increased transportation activity, and wherever you find raw materials or finished products to be moved, you will find motor trucks.

"Even the railroads are turning to motor trucks to overcome terminal congestion. Instead of the usual system of sending out daily shuttle cars to each railroad, it has been found more practical to have motor trucks transfer the freight from one depot to another. Not only does this tend to clear the rails but motor trucks can do this kind of short-haul work more promptly and at lower cost than is possible with shuttle trains."

NATIONAL SAND & GRAVEL ASS'N TO URGE HIGH-GRADE MATERIALS FOR CONCRETE MIXTURES

A national campaign intended to point out the advantages of using high-grade materials only in concrete mixtures is to be undertaken by the National Sand and Gravel Association. The proposal was brought out by the board of directors during the annual meeting of the association in Washington, January 24-26, and was approved unanimously on the floor of the convention. While the principal effort will be to convince contractors that it is poor economy to use low-grade sand or other materials in mixing concrete, a publicity campaign will be undertaken to acquaint the public with the fact that the value of an investment in concrete depends to no small extent on the grade of the aggregates used in connection with the cement.

CONCRETE ROAD TO BE EXHIBIT AT INTERNATIONAL ROAD CONGRESS IN SPAIN

As a sort of permanent exhibition for the International Road Congress which is to be held in Seville, Spain, next May, a sample section of concrete road about 3 kilometers in length is being constructed on the outskirts of that city, says "Successful Method." American machines are being used and the road is of American design, although, of course, Spanish methods have their share in the actual construction work.

The road on which the paving is being done is a Provincial road called Dos Hermanas and leads from Seville in the direction of Cadiz. It later will be connected with other avenues which will pass through the grounds of the Spanish-American exposition.

The cross-section of the road is 5 and 6 meters in width. The slab is 6 in. thick, reinforced along the edges by increasing the thickness to 9 in. It is similar to the slab in use on the roads of Maricopa County, Arizona, and to the new Illinois specifications.

The aggregates are obtained from the pit of the Guadalquivir River and hauled to the work on motor trucks. As it was necessary to get the job done in plenty of time for the Road Congress, and as it was impossible to bring a standard paver from America, a small portable mixer has been used. Extremely good results have been obtained and the crew in charge has become expert in moving the mixer as the work advances. It so happens that the section of road which is being built does not pass through an irrigated district, and it is necessary to bring all the water used in the mixer and for curing in a tank automobile truck.

TRANS-CANADA ROUTE NEARING COMPLETION

Completion of Canada's transcontinental highway is fully expected by the end of 1925, and greatly increased tourist traffic is confidentially expected. The only gap in the Trans-Canadian Highway which will remain unclosed by 1925 will be that between Sault Ste. Marie and Fort William Ont. A movement is already under way, however, to have Ontario arrange in the near future to forge this last link so that Canadian and American motor tourists can drive from the Atlantic to the Pacific on a first-class road built entirely in Canadian territory and which will embrace scenic grandeur unrivaled by any other highway on the continent. The only gap in the Trans-Canada Highway between Winnipeg and Vancouver is that between Princeton and Hope and work will commence on it in the Spring. Although there will be much rock work to be done on this eighty-mile stretch it will be completed by 1925. One other gap, that between Rossland and Cascade, a distance of 19 miles, was closed a few months ago. At a cost of $1,000,000 the province of Quebec is building two bridges at the western end of the Island of Montreal, which, with the construction of about 25 miles of road to the Ontario border, all to be done by December 31, 1923, would complete the last link in the Toronto-Montreal highway. This means that by the Spring of 1924 there will be a continuous modern highway from Windsor, Ont., to Halifax, N. S., a distance of approximately 1,600 miles, and which motor tourists could cover comfortably at a reasonable speed in from six to eight days.

The Canadian Good Roads Association has decided to petition the Federal Government that a further grant of $20,000,000 be made to aid the provinces in highway development and also an extension of time to those provinces which had been unable to take full advantage of the first appropriation within the time limit set.

ILLINOIS TO CARRY ON EXPERIMENT IN EARTH ROAD OILING

Arrangements have been completed and plans are well under way for carrying out some extensive field experiments in earth road oiling during the coming summer near Cambridge, in Henry County, Illinois. The Illinois Division of Highways, in co-operation with Mr. J. H. Reed, county superintendent of highways, plans to construct an experimental oiled earth road of a number of sections employing the different kinds and grades of oil commonly used in Illinois on some sections and oil in varying quantities on other sections and observing the results under actual traffic conditions. It is also planned to study other important factors entering into the construction of oiled roads among which may be mentioned the effect of soil and subgrade conditions, the effect of extremes of weather conditions and the methods of heating and applying oil.

Approximately 14 per cent of the total mileage of public roads in Illinois is now oiled and no doubt carries much greater proportion than 14 per cent of the total traffic.

Surface oiling of earth roads was first practiced in Illinois in about 1910 or 1911 and since that time has made rapid strides until at the present time it constitutes one of the most important methods of road maintenance in the state. This rapid development may be accounted for first by the lack of local supplies of stone and gravel which could be utilized for other types of roads. Second, the rapidity and ease of construction of oiled roads. It is usually possible for a county or township to oil and maintain its entire system of roads throughout a season without an excessive outlay of equipment and at a moderate expense. It is possible to drag an oiled earth road practically throughout the year. The oil prevents the surface from freezing tight and otherwise keeps it in condition for dragging when an ordinary earth road cannot be so maintained. Third, a properly constructed oiled earth road is very agreeable to traffic and this feature has contributed in no small degree to its popularity and the demand on the part of the public for its construction.

While earth road oiling in Illinois dates back but little more than ten years, it has been practiced in certain other states for a much longer period, but owing to the climatic and soil conditions, and the peculiar varieties of oil available. Ilinois has benefited but little from outside experience and the methods of construction, maintenance and oil specifications which have come into use are almost entirely the results of her own experience.

In an effort to find a solution to some of the above mentioned problems and to effect a better and wider understanding of the best method of constructing oiled earth roads, under conditions existing and with materials available in Illinois, this experiment is being undertaken.

Experimental Road Testing

(*Continued from Page* 121)

angular corner repairs of rigid material will also help, as the obtuse angled corners of the adjacent old slab will carry greater loads than right angled corners. Limiting the loads to the strength of the slab would of course solve the problem for old pavements.

Suggestions for Improved Designs

Designs for new pavements should undoubtedly provide for strengthened edges. This may be accomplished by providing integral curbs which would not only strengthen the edge but largely prevent wheel loads from being applied to the extreme edge. It is believed that wider pavements with integral or invertd curbs, using no more or even less material than is now used in many designs, would afford equal or possibly greater load carrying capacity. Merely incresing the width would undoubtedly prolong the life by reducing the frequency of the passing of heavy wheel loads off and on, and along the edges.

Longitudinal joints in concrete pavements reduce the warping due to changes of temperature, thus increasing the possibility of subgrade support along the edges under night traffic. Such joints should be provided with tie bars to prevent spreading, and a corrugated or tongue and groove effect so that the adjacent slabs would afford mutual support.

The terms of the Illinois Bond Issue Act prevent general construction of pavements wider than 18 ft. Integral curbs on pavements of this width would probably inconvenience traffic and for this and other reasons are not generally used. To increase the edge strength, the new Illinois design provides for a 9 in. edge thickness, tapering to 6 in. at 2 ft. from the edge. The edge is also strengthened by a continuous ¾ in. round smooth bar. The remainder of the slab is uniformly 6 in. thick. A tongue and groove longitudinal joint is provided across which is placed deformed tie bars.

Four sections of this type have been added to the Bates Road; and will be tested by truck traffic early next spring. We confidently believe that the results will show this design to have an ample factor of safety for the Illinois legal limit loads.

Development of the Asphalt Industry in the United States

Prior to 1902 the term asphalt was confined almost exclusively to certain semi-solid or solid bitumens which were found in natural deposits most of which occurred in admixture with clay, silt or vegetation which could not be removed by ordinary refining methods. When the mineral matter predominated the product was termed asphaltic sand or rock asphalt depending upon whether or not the mineral structure was loosely or firmly knit together.

No appreciable tonnage of asphalt was used in this country until 1883 when about 35,000 tons were imported mainly from Trinidad and found its way into the paving industry. Prior to this relatively small quantities of Trinidad asphalt and certain European rock asphalts or bituminous limestones had been used in the construction of pavements in a few American cities.

In 1892 a relatively pure asphalt deposit occurring in Venezuela and known as Bermudez Lake asphalt was exploited in small quantities and this product began to find its way into the United States where it was also used in pavement construction. From this time on Trinidad asphalt was obliged to share honors with Bermudez asphalt, the importation of which gradually increased until in 1919 it was nearly equal in tonnage to the Trinidad asphalt.

Other foreign asphalts occurring in Venezuela, Cuba and elsewhere have appeared temporarily on the American market but never in any great quantity. Large deposits of asphaltic sands and rock asphalt have been found in this country but their development has been limited.

Practically all native asphalt is too hard for direct use in the manufacture of asphalt products and after a simple refining process which consists in heating the crude material until water, gas and other volatile material is driven off, it must be softened to suitable consistency by combining it with the proper amount of residual petroleum known as flux oil. Petroleum therefore always served as an important integral part of all asphalt used for industrial purposes.

Petroleum Asphalt

The petroleum, first known and used in the United States occurring in Pennsylvania, Ohio and Indiana was of the paraffin type. When distilled to remove the more volatile constituents this petroleum was found to yield a thick greasy oil residue which in no way resembled asphalt except in color but which proved quite satisfactory for use as a flux. If distillation was carried further this residual oil underwent certain chemical changes due to cracking of the hydrocarbon constituents and eventually coke remained in the still.

With the discovery and refining of California petroleum it was observed that when the residual oil was further distilled and before coke was formed, a semi-solid residue was produced which very closely resembled the native asphalts. The original petroleum was therefore called asphaltic petroleum. The asphalt first produced from this type of petroleum proved to be of rather inferior quality, the cause of which was later shown to be due to the high temperatures required to drive off a sufficient amount of oil constituents to produce a semi-solid residue.

By 1902 petroleum asphalt was on the American market in appreciable quantities, about 20,000 tons being manufactured during that year. It found its way into the paving industry where it was received on trial for a number of years until service over a considerable period of time demonstrated that it was equally as good for paving work as the lake asphalts. By 1911 the tonnage of asphalt produced from domestic petroleum exceeded the importation of Trinidad and Bermudez asphalt and from that time on the production from this source has grown rapidly.

In 1913 large quantities of Mexican petroleum found its way into the United States. This petroleum is highly asphaltic in character and when subjected to steam distillation yields a much higher percentage of asphalt than any petroleum found in the United States. About 100,000 tons of asphalt were produced in 1913 from this source as compared with about 230,000 tons of imported native asphalt and over 400,000 tons of asphalt produced from domestic petroleum. That year showed the peak of importation of native asphalt which was then equal to only a little more than two-fifths of the total production from petroleum. From that time on there has been a general decline in importation of lake asphalt with a very rapid increase in asphalt distilled from petroleum.

Abstracted from a pamphlet issued by The Asphalt Association.

GOOD ROADS

Title Reg. U. S. Pat. Off.

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The Flow of Water Through Vitrified Clay and Corrugated Metal Culvert Pipe

Results of an Extensive Investigation Conducted by U. S. Bureau of Public Roads at State University of Iowa Hydraulic Labaratory—Capacities of Two Kinds of Pipe Compared—Values of Coefficient of Roughness in Kutter Formula

THE most comprehensive investigation ever made of the flow of water through vitrified clay and corrugated metal culvert pipe has been recently completed by the U. S. Bureau of Public Roads at the Hydraulic Laboratory of the State University of Iowa. The investigation has brought to light a mass of interesting hydraulic data of a theoretic nature as well as valuable practical information.

On account of the scarcity of reliable information previously available on this subject and in view of the fact that large amount of both State and Federal funds are being spent for pipe culverts, Thos. H. MacDonald, Chief, Bureau of Public Roads, arranged for this cooperative investigation on the part of the Bureau and the State University of Iowa. Due to the very careful preparations and planning for the experiments made in advance by the Bureau, to the cordial assistance of A. F. Fischer, County Engineer of Johnson County, Iowa, in furnishing some of the material for test, and to the unique facilities of the laboratory, particularly adapted to this kind of experimentation, the tests, including nearly 1,000 separate measured runs, were completed with unusual expedition according to schedule, and without any untoward delay.

To conduct an investigation of such magnitude, a location was necessary with an ample supply of water and a sufficient gravity supply, but the laboratory of the State Uiversity of Iowa located at Iowa City met the necessary requirements for this work admirably.

Scope of Experiments

Tests were made on both vitrified clay pipe and corrugated metal pipe to determine accurately the effect of friction on the flow of water through culverts and the entrance losses at the culvert inlet. The sizes tested of each kind of pipe were 12, 18, 24 and 30 in. in diameter. To determine the effect of the length of the culvert on its capacity, the 24-in. pipe of both materials was tested in three lengths, namely, 24, 30 and 36 ft. The other sizes were tested in the 30-ft. length only. Many different types of entrances were tried in order to determine which forms were most effective in reducing the entrance loss. These included various conical entrances as well as all of the standard types approved by the Bureau of Public Roads, consisting of the straight endwall entrance, wing walls set at 45 deg. to the pipe line, and the U-type wings. The effect of varying the height of the wingwall was also tested.

The Testing Equipment

The testing canal of the laboratory, is 130 ft. long, 10 ft. wide and 10 ft. deep. A standard sharp-crested measuring weir of the suppressed type, whose crest was 10 ft. in length, was installed 62.4 ft. from the headgate at the dam. The pipe was laid level with water-tight joints on a wooden floor in the bottom of the testing canal.

Tight wooden bulk heads were installed at each end of the pipe line, so that the pipe could remain exposed in the dry while running full of water even with both ends submerged to a considerable depth. The entrance to the culvert pipe was located 26.8 ft. downstream from the weir. Three baffles were placed in the canal above the weir near the headgate in order to obtain a uniform distribution of velocity of approach to the weir. In order to still the turbulance of the water in the canal below the weir, before it entered the culvert pipe, two baffles were installed in this section.

Piezometer nipples were inserted in each kind of pipe spaced 30 in. apart throughout the whole length of the pipe. These nipples were connected by rubber tubing to graduated glass tubes laced on the side of the canal. (See illustration on cover.) Hookgages set in cylindrical galvanized-iron stilling tanks near the bulkheads at the two ends of the culvert were used to determine the elevation of the water surface upstream and downstream from the culvert.

Tests on each culvert were begun with a head of 0.30 ft. of water discharging over the measuring weir followed by experiments with successive increases of 0.10 ft. in head on the weir until the maximum quantity was obtained which would flow through the pipe without

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overtopping the bulkhead at the entrance to the culvert. For each head on the weir several different tests were secured, as follows: (1) with the outlet discharging freely into the air; (2) with the elevation of the water surfaces at the culvert outlet raised to the middle of the pipe; (3) with the water surface at the outlet brought up to 6 in. below the top of the pipe; (4) with the water surface raised to the top of the pipe at the outlet; (5) and with the water surface at the culvert outlet raised by successive increases of 6 in. until the maximum possible submergence was secured. To obtain a submerged outlet a bear-trap gate was constructed 18 ft. downstream from the outlet. This gate was regulated by means of a block and tackle.

Procedure of Testing

The quantity of water being carried by the culvert was measured by a standard sharp-crested weir of the suppressed type. For determining the discharge over their weir, Bazin's formula was used. From 5 to 7 min. were consumed in making a complete test which required the services of five men. One man was stationed at the weir hook-gage; another was located at the hook-gage near the culvert inlet; a third read the piezometers; and a fourth read the hook-gage located near the culvert outlet. A fifth man regulated the head gate and operated the beartrap gate.

An electric bell was placed directly over the culvert pipe being tested and another bell connected on the same circuit was placed on the observation platform at the weir hook-gage. The push button for operating these bells was located at the hook-gage near the entrance to the culvert.

After the headgate was correctly adjusted for the required head on the weir, the water level at the culvert inlet was observed until the stage had become steady. The pipe was then ready to be tested. The observer at the hook-page at the culvert entrance operated the bell in addition to reading the hook-gage. He signalled to all observers by means of two rings to get ready to read. Ten seconds later one bell gave the time to read, after which it was rung every 30 sec. until ten consecutive readings had been secured. Three bells denoted the end of a test. During the time the hook-gages were being read the observer of the piezometers as well as single readings on each hook-gage. At the close of a test the readings indicated whether the water stage had been constant. If it had not been closely stationary, the test was repeated.

Experimental Results

At the conclusion of each test the average values of all the different readings were plotted on a diagram which was, in effect, a condensed profile of the pipe under test. Fig. 1, A, B and C are representative sample diagrams. Near the right margin of each diagram is shown the head water level above the entrance to the pipe; at the left margin similarly is shown the tail water level at the outlet of the culvert. Along the pipe in their proper respective positions are shown the elevation of the water in the various piezometer tubes. The diagram shows then at once the amount of submergence of each end of the culvert pipe and the total difference in water level between the bays at the two ends of the pipe.

Through the points representing the water level in the various piezometer tubes an average straight line was drawn, as shown on the diagrams. This line represents the hydraulic gradient in the pipe. The diagrams show strikingly that while at the outlet end of the pipe the hydraulic gradient nearly meets the tail-water level,—frequently slightly below it,—on the other hand at the entrance end of the pipe the hydraulic gradient is always far below the head water level. The slope of the hydraulic gradient is the true friction loss within the pipe. The difference between the head water level and the hydraulic gradient at the entrance to the pipe represents the head required to get the water into the pipe and may be called the entrance drop.

From the quantity of flow as measured by the weir and the measured cross-section of the pipe the velocity of flow through the pipe was computed for each test. Next the corresponding velocity head was computed. The entrance drop can never be less than the velocity head. For a rounded entrance, that is one having no sharp corners, the entrance drop is substantially equal to the velocity head. When the entrance drop is appreciably greater than the velocity head, the difference is called entrance loss, as indicated on the diagrams.

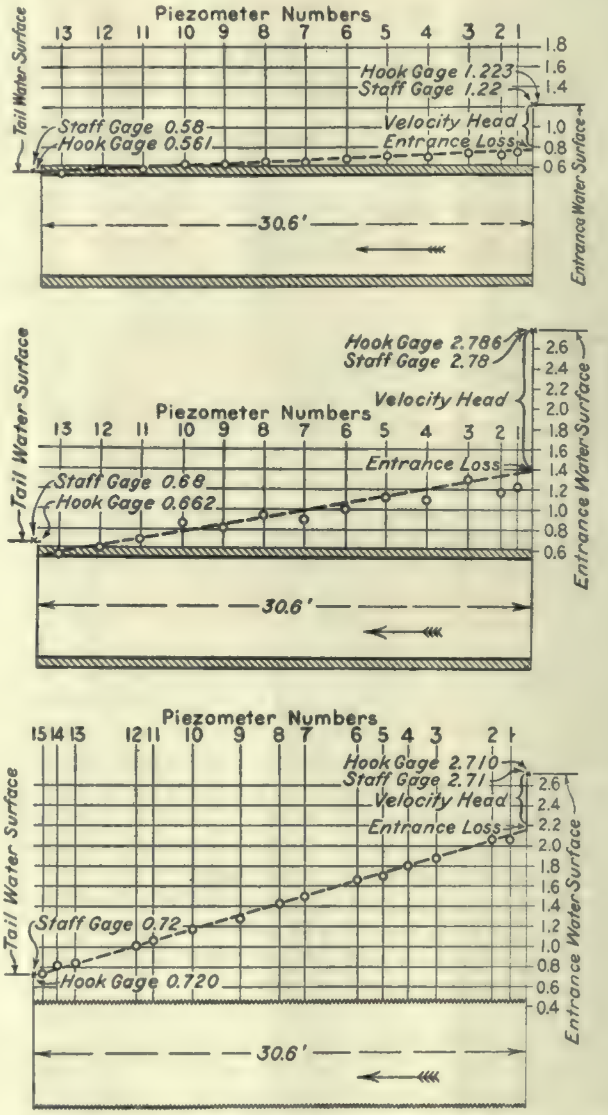

Fig. 1. Characteristic Curves From Tests

B—12 in. corrugated metal pipe—30 ft. length, straight endwall entrance, steep slope.

C—12 in. corrugated metal pipe—30 ft. length, straight endwall entrance.

A—12 in. vitrified clay pipe, 30 ft. length, straight endwall entrance, flat slope

By taking sufficient care to make a gradually rounded entrance, the entrance loss can always be reduced practically to zero. When the bell end of a vitrified clay pipe is used as the entrance, the entrance loss is almost zero. With the reinforced rounded end of a corrugated metal pipe the entrance loss amounts to 15 or 20 per cent of the velocity head.

The piezometer readings usually show more or less inconsistency among themselves, especially with the higher velocities used. Certain piezometers would persistently read higher or lower than their neighbors, due, apparently, to some disturbance of flow within the pipe. The piezometer readings were more erratic in general with the vitrified clay pipe than with the corrugated metal pipe. The piezometer closest to the entrance end of every pipe invariably showed a reading below the average hydraulic gradient when the velocity was high.

Perhaps the most surprising thing about these diagrams is the striking way in which they reveal the fact that for such short pipe the element of friction in the pipe itself is much dwarfed in comparison with the head consumed at entrance in getting the water into the pipe. As shown on Fig. 1A, the friction head for the 12-in. clay pipe was much less than the velocity head consumed at entrance. This relation is independent of the velocity of flow, for as the velocity increases both the friction loss and the velocity head increase in substantially the same proportion. For pipe of larger diameters the fritcion loss has less importance.

With corrugated metal pipe the friction factor is much greater than with clay pipe and is therefore of greater importance. Fig. 1C shows a 12-in. corrugated metal pipe carrying nearly the same quantity of water as is carried by the 12-in. clay pipe represented in Fig. 1A. Although the velocity head is about the same in the two figures, the friction head in Fig. 1C is several times as great as in Fig. 1A. The friction loss in vitrified clay pipe and corrugated metal pipe may be compared by calculating for each the coefficient of roughness by Kutter's formula. When this was done it was found that the results vary slightly with different sizes of pipe and different velocities of flow. For clay pipe the values obtained for Kutter's *n* varied between 0.011 and 0.014; for corrugated metal pipe between 0.019 and 0.024. The greater resistance to flow in the metal pipe is undoubtedly caused by the corrugations.

TABLE 1.—CAPACITIES OF VITRIFIED CLAY AND CORRUGATED METAL CULVERT PIPE 30 FEET LONG UNDER A HEAD OF ONE FOOT.

Kind of Pipe	Diameter of Pipe in Inches			
	12	18	24	30
	Capacity in Cubic Feet per Sec.			
Vitrified Clay Pipe	5.3	11.9	22.4	22
Corrugated Metal Pipe	3	7.9	15.8	24.9

A section was cut out of the top of each kind of pipe of the 24-in. size and through this opening a photograph was taken of the moving water. Fig. 2A shows the filaments of flow in the 24-in. clay pipe. In the corrugated metal pipe the filaments of flow are broken up very much more as may be seen in Fig. 2B.

To enable practical application to be made of the results of these experiments the following condensed table has been prepared showing the relative carrying capacities of a 30-ft. length of the two kinds of pipe for the various sizes when operating under a head of one foot. The difference of elevation of the water surfaces at the entrance bay and outlet end of the culvert is considered as the head under which the pipe is flowing.

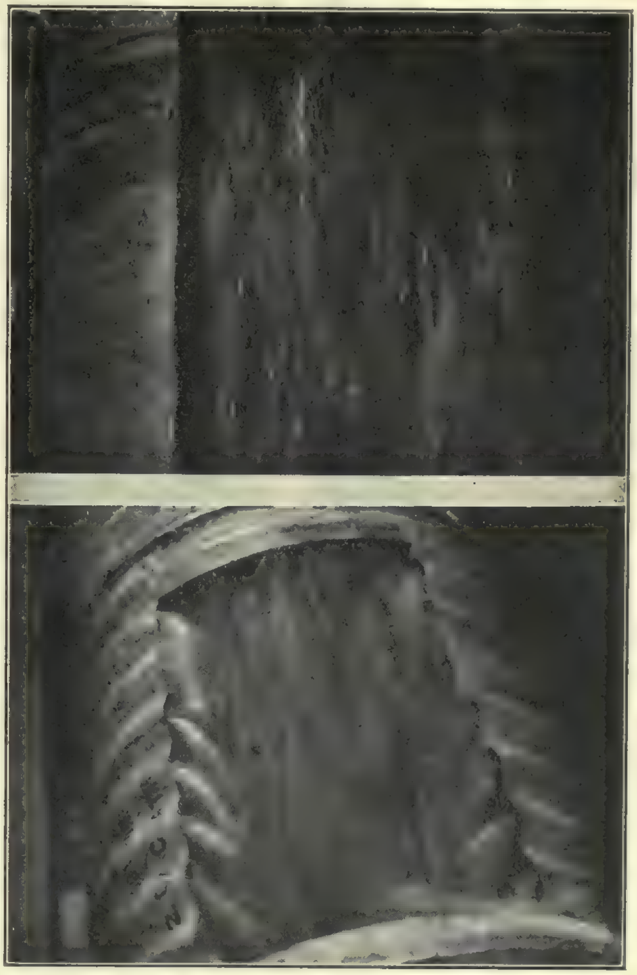

FIG. 2. TYPICAL FLOW THROUGH CULVERTS

A (above)—Water flowing through 24-in. vitrified clay pipe. Depth of flow 1.82 ft. and discharge 20.95 sec. ft. Note smooth lines of flow.

B (below)—Water flowing through 24-in. corrugated-metal pipe. Depth of flow 1.82 ft. and discharge 17.88 sec. ft. Note the disturbance of flow due to corrugations.

The table shows that a culvert made of vitrified clay pipe will carry from 28 to 77 per cent more water than one of corrugated-metal pipe, depending upon the diameter of the pipe.

Throughout the experiments every care was taken to obtain independent checks on all readings, and to test all the results obtained by variations sufficiently numerous to detect any erratic observation and to afford finally reliable average values of all constants. The results obtained are not only of immediate practical value, but incidentally there has been secured much data that will throw light on some of the phenomena of flow in pipes with regard to which information hitherto has been scant and inadequate. It is expected that within a few months a full report will be ready for publication giving

(Continued on page 137)

The Construction of Highways in Iowa

How the State Is Now Planning for Its Future Transportation System

By C. COYKENDALL

Assistant Chief Engineer, Iowa State Highway Commission

NO single problem is provocative of more difference of opinion than that of the proper policy for the development of a highway transportation system. Nor is it surprising that such should be the case, for there is no one proper solution to the problem. Obviously, the proper solution of Rhode Island's highway problem will not apply equally well to the highway problems arising in Texas, nor can a solution that is proving effective in Pennsylvania be unqualifiedly recommended for Wyoming. The problems arising in connection with the building of a system of highways are manifold, and fortunate indeed is the state which has highway laws flexible enough to fit all conditions within the state, and officials in charge of highway work possessed of sufficient vision, courage and authority to apply the proper solution to the various problems confronting them. If such a state there be, let it be known, in order that the law makers and highway officials of other states may journey thence and become enlightened.

The Problem in Iowa

Iowa's road building problems are not exactly duplicated elsewhere. The state his 56,000 square miles in area and more than 104,000 miles of rural highway, with practically every one of these miles, to a greater or less degree, an essential part of the state's highway transportation system. Every section of the state is productive, and consequently is inhabited. Excluding the population resident in cities and towns, it is found that the density of rural population is remarkably uniform throughout the state, with a correspondingly uniform need for a usable system of rural highways throughout the state.

Let us consider for a moment the sources and kinds of traffic that the roads in Iowa are called upon to carry. The surplus products of all section of the state must be hauled over rural highways to the shipping and market points, and from these same shipping and market points, coal, machinery, lumber and other materials and supplies must be hauled back to the farm. Heavy tractors for operating threshing machines, corn shellers and silo fillers must be able to move from farm to farm, and for this purpose, substantial bridges are necessary. A constantly increasing percentage of the children of the state are being educated in modern, consolidated schools, and the school busses in which these children ride to and from school nine of every twelve months of the year, must have safe and usable roads and bridges over which to travel. In those sections of the state within a radius of 50 miles of great meat packing centers such as Sioux City, Omaha, and Nebraska City, it is found highly economical to market livestock by truck instead of by train, as it is found that the increased transportation cost by truck haulage is much more than offset by the small shrinkage in weight of the livestock hauled by truck, as compared to the shrinkage when hauled by train. In the vicinity of all considerable centers of population, slow and costly railway and express service is being supplemented by motor transport. Two of the nation's best marked and most widely-known transcontinental highways, and many other important but less widely-known interstate highways, cross the state. Yearly the interstate traffic on these highways is increasing. Traffic counts taken during the past season at a point east of Ames, where for a short distance the Lincoln Highway and the Jefferson Highway use the same road, show that of a total average daily traffic amounting to 1036 vehicles, 148 vehicles or 14.3 per cent of the total traffic was motor cars with foreign licenses. And last but by no means least, the five hundred thousand motor cars owned in Iowa are decidedly active organisms, penetrating every nook and corner of the state, on business or pleasure bent, and requiring roads—usable roads.

From the foregoing, it will be seen that the various classes of roads in Iowa are called upon to carry almost every known variety of modern highway traffic, and the suddenness with which most of this traffic has developed is the element that makes the problem of providing adequate highways so stupendous. If the development of highways in Iowa during the past decade were to have kept pace with the development of traffic using those highways, there should have been constructed during that time at least 2,500 miles of paved road, at least 25,000 miles of graveled or similarly surfaced roads, another 25,000 miles graded and drained, and the remaining mileage maintained in usable condition and safely bridged. Such a program of improvement would have cost approximately a half billion dollars, whereas the actual total highway expenditures during this period amounted to approximately $195,000,000.00, or 39 per cent of what would have been necessary had highway improvements kept pace with the development of highway traffic.

On the other hand, during the same period of time the people of Iowa have invested more than three-quarter billion dollars in automobiles, thus showing a much greater liberality in the financing of privately owned rolling stock than in the financing of publicly owned road beds.

Recent Development

In most respects the citizens of Iowa are conservative. Having no great centers of population, her policies as a state are formulated largely by the people of the rural communities—people whose personal prosperity has resulted from conservatism in their personal affairs and who naturally are wont to apply the same policies to public affairs. Logically enough, therefore, Iowa's highway policies have always been conservative. Until 1904, Iowa as a state took no part whatever in road building activities. All such work was under the supervision of county and township officials. Bridges of 16 ft. span or more were known as county bridges and were built and maintained by the county. In addition to this, county boards of supervisors had authority to levy a small tax, known as the county road tax, the proceeds from which could be spent on road work by the county supervisors at their own discretion as to location and type of improvement. As the condition of roads and bridges was a matter almost wholly of local concern,

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Abstract of a paper presented at the annual convention of the American Road Builders Association, Chicago, January 16-19, 1923.

logically enough the administration of highway matters had remained vested in local officials.

About twenty years ago, when it first began to occur to some of the more forward-looking that the existing method of handling matters pertaining to roads and bridges might not be all that could be desired, it was natural that bridges and culverts received first consideration. Travelers on the road at that time could usually choose favorable weather conditions for making their trips, but the bridges and culverts had to be crossed. Further, about this time the heavy steam tractor was coming into more general use and was playing more or less havoc with flimsy bridges. Naturally the owners of these tractors wanted better and safer bridges built, and these same owners, through their state threshermen's association, later proved to be one of the most effective agencies in securing progressive road legislation.

The State Highway Commission, created by legislative enactment in 1904, was vested with only advisory powers. Such counties as desired could avail themselves of the Commission's engineering services and advice, although there was nothing obligatory that such advice must be followed. Accomplishments during the period that this system was effective—1904 to 1912 inclusive—were entirely along the line of progressive construction. A large number of counties commenced building bridges and culverts of permanent construction and cutting down hills and filling hollows adjacent thereto. Toward the close of this period the use of large blade graders drawn by gasoline tractors became quite general, resulting in the building of a considerable mileage of dirt roads to a natural grade, and to sections closely approaching present day standards. Very little surfacing work of any kind was undertaken except for short stretches of gravel surfacing here and there in progressive communities where an abundance of local gravel was available.

In the spring of 1913, radical highway legislation was enacted by the state legislature, which resulted in a complete change in the method of handling highway work. This legislation reorganized the State Highway Commission, clothing it with drastic supervisory powers, and providing adequate funds for its support. Under this statue the state continued its policy of non-participation in the cost of road building, but required all highway construction work, both road and bridge, to be done in accordance with plans and specifications either prepared by or approved by the State Highway Commission. Other outstanding features of this legislation were the requiring of each county to employ a county engineer to supervise road and bridge construction work, and the classification of highways into a county system and a township system, the former being placed entirely under the supervisoin of county officials, and the latter remaining under the jurisdiction of township officials, with the restriction that any construction work upon the township road system must be done in accordance with plans prepared by the county engineer and approved by the State Highway Commission.

Under this scheme of operation, real strides were made in the way of progressive road construction, particularly upon the county road system. By the end of 1916, approximately 1600 miles had been built to established grade in accordance with approved plans; approximately 25,000 bridges and culverts had been constructed of so-called permanent construction; practically the entire mileage of the county road system—some 15,000 miles in all—had been constructed to natural grade and standard section and was being rather systematically maintained; in fact, Iowa had acquired a

(Continued on page 137)

The New Dunes Highway

The Developement of Indiana's Historic Road

By C. H. PARRISH

Indiana State Highway Commission

STEPS are being taken by the Indiana State Highway Commission to rush to completion early in the spring the Dunes highway in Lake county. Work on this important road was held up the latter part of 1922 due to a legal tangle relative to securing a short section of right-of-way and the inability of the contractor to procure the necessary materials at the desired time.

Indiana's picturesque drive extends for approximately 20 miles from Gary, an important steel city, through Michigan City and on to the Michigan state line, forming the boundary line of the world famous Dunes—a 20-ft. wide concrete pavement of alluring attractiveness. It follows to a great extent through Indiana the short route used by mail horseback riders between Detroit and Chicago one hundred years ago, and traverses a section which twentieth century travelers heretofore could not utilize on account of the sandy stretches and low lands through which the road runs. The new Dunes highway makes readily accessible the Dunes; eliminates nine railroad crossings, and reduces the mileage seven miles between Gary and Michigan City, compared with the shortest route heretofore available.

From Walter G. Greenbaum, secretary-manager of the Michigan City Chamber of Commerce, the Indiana Highway Commission recently received valuable historical data, a part of which is incorporated in this article which shows that the Dunes highway is a matter of extreme interest to the nation and especially to the great army of automotive travelers. This road, says Mr. Greenbaum, provides a ride of twenty odd miles through romantic duneland, passing many places of historic record and locations of present day history.

Much of this wild territory lying between one of the nation's greatest industrial cities and Michigan City, an important Hoosier metropolis, is almost identical as it was a century ago. Thirteen miles of this roadway was completed late in December of 1922. The other six miles will be completed early in the spring or just as soon as weather conditions permit the laying of concrete. The road is 20-ft. wide with 8 in. base, and is being built to withstand the heaviest traffic which may pass across same.

The Dunes highway passes many points of historical interest. At Michigan City there is Krueger Memorial Park in which was fought the Revolutionary battle of

December 5, 1780, when a small force of Americans, about eighteen in number, was defeated by a force of British and Indians. In this same park also is the Father Marquette Spring, where Father Marquette encamped on his journey from the East to Chicago. The spring is still flowing. Father Marquette used this route of the present Dunes Highway on his westward journey.

At the outskirts of Michigan City the route passes the Indiana state prison, an institution noted throughout the world as a model of its kind, and housing approximately 1500 inmates. Heading west from the prison one sees on the left the old roadbed of the Buffalo and Mississippi railroad. This enterprise was one of the many dreams of early pioneer railroad builders to connect the East with the Mississippi Valley. Some work was done on it in 1850, but soon afterwards abandoned.

Before reaching Furnessville a splendid view is obtained of the Dunes showing the world famous "Polk Slide," a high plateau of sand, through which the Chicago-Detroit Stage road came from the lake shore. A short distance west of Furnessville is the wonderful Furnessville "Blowout" nearly half a mile long and 60 ft. high, with its striking clusters of magnificent white pines, many over a 100 ft. high and over 2 ft. thick.

Proceeding westward, at Tremont, known years ago as "New City West," the highway reaches about the center of the Dunes section. Tremont was the old village of the Mound Builders. About a block south of the highway may be seen their cemetery, containing over one hundred mounds. Toward the lake from Tremont may be seen the great sand peaks that give the name Tremont to this wonderful region. They are Mts. Tot, Green and Holden. The Chicago Prairie Club has a beautiful five-acre park and cozy beach house overlooking the lake near Mt. Holden. This Club has long consistently brought the attention of thousands of pilgrims to admire the beauties of this section.

Two miles beyond Tremont the Dunes highway crosses Waverly Beach road. Waverly Beach is one of the finest bathing beaches in the whole Dune region. There, on Fort Hidge, was located Petite Fort—Little Fort-of-the French, erected about 1750 to protect the fur trade of the Calumet region from the Iroquois Indians who, history tells us, thought nothing of a foray from New York to the Chicago-Dunes region.

It was here at Waverly Beach that City West was started 1837 to surpass Chicago, Milwaukee and Detroit and become the metropolis of the Great Lakes. Daniel Webster visited City West in 1837 and supported its request for a Government Harbor. The request of Michigan City was backed by Henry Clay and Michigan City was successful in getting a fund from the government to start its harbor development.

A little west from Waverly road is Mineral Springs. Here is the famous Cowles Tamarack Swamps, named after Dr. Cowles, nationally famous botanist of is the most beautiful floral treasure house with its rare trees, shrubs, vines and flowers, to be found in the entire Dune-Chicago region. Near Oak Hill on the south side of the highway is the Bailly Mausoleum containing the bodies of the great furtrader Joseph Bailly, who formerly owned 2,000 acres in this vicinity and who history tells us, was one of the greatest fur traders in America. A mile north is the old Bailly homestead, the oldest home in Northern Indiana, having been erected in 1822. It is a religious home now presided over by Rev. Elberly.

In Gary, one of the great cities of the middlewest and which was literally created in a Dune waste land by the gigantic steel industries, the highway connects at Fifth Avenue with the former Chicago-Gary route.

Dunes highway is one of the best roads built in the state. Its route was selected after Governor Warren T. McCray and members of the Indiana Highway Commission visited the locality several times and became thoroughly familiar with how much the future development of the district depended on a rigid type highway; also the wonderful natural resources and scenic effects that would be made readily accessible through such.

THE DUNES HIGHWAY IN INDIANA

The construction of the Gary end of the Dunes highway completed late in the summer of 1922, was considered the most unique road building project in Indiana state highway construction. For a mile and a half the road passes through a swamp. When the contractor started his equipment into the section to dredge out the marshland to make a fill for the right-of-way, it was necessary to remove many, many tons of muck and vast quantities of decaying vegetation. Many difficulties were experienced in making this fill, chief of which was in getting machinery on the ground. At one time a 30-ton dredger, caterpillar type, mired and it was necessary to attach it by long cable to an interurban car passing near, which incident cost the contractor $1,000 alone, he says. So important an engineering feat was considered construction of this road through the swamp, that it was watched by engineers from many states.

The road forms a link in a highway to extend entirely around Lake Michigan, and which it is hoped will be built within the next two years. In this event even the entire distance of 700 miles will then be possible

(Continued on page 138)

Tourist Traffic as a Factor in Highway Development

By A. R. HIRST

State Highway Engineer of Wisconsin

BEFORE discussing this subject it will be well to define the meaning of the word "tourist." Webster's Unabridged gives as the definition of tourist, "One who makes a tour; one who makes a journey for pleasure, stopping at a number of places for the purpose of seeing the scenery, etc."

Quite commonly the term "tourist" has been accepted to mean one who is traveling for pleasure at some distance from his home environment. In many states the term "tourist" means a person from without the state. There is no justification for these distinctions. If we accept the Webster definition the tourist traffic on our highways is all traffic using the highways as a part of a sightseeing or pleasure trip. Therefore, in the consideration of tourist traffic we must include not only the traffic traveling in cars coming from without the state, but the traffic of the people of the state itself. This paper will, therefore, concern itself with the effect of this pleasure and sightseeing traffic upon the development of the highway systems of states.

Effect of Tourist Traffic on Location

We doubt very much whether tourist traffic has had or will have any large effect upon the type of highways or the location of highways of any state. There are, of course, exceptional instances where highways are built exclusively to make accessible to tourists certain areas or certain specific features of scenic or historic interest, and in those specific cases the volume and character of the tourist traffic will indicate the necessity for and will dictate both the location and character of the road.

In the vast majority of cases, however, in every state, regardless of the amount of tourist traffic using the area, it is our opinion that the location of the highway and its type will be dictated almost entirely by the business uses which the road must be built to serve.

In very few cases will a superiority of alignment of grade or surface be indicated and forced by the amount of tourist traffic over a principal state highway. In some cases on roads heavily traveled by tourist traffic the amount of this traffic will dictate a wider type of surface than would have to be built to serve the business traffic, but it is our opinion that these cases are very limited. The thing that is going to dictate the location and type of the great majority of our highways is the demands and uses of motor trucks, motor busses, and of the local tributary heavy business.

There are some roads in areas, which are not business areas, and where roads are built and maintained largely to serve tourist traffic, the location of which will be dictated solely by the requirements of tourist traffic.

In such areas of scenic or resort value, the location and alignment of roads will and should be dictated, not by the theoretical requirements of shortness of distance and ease of grades which should prevail in the construction of main roads built for business service, but the locations will and should be largely predicated on making the roads as pleasant to travel as is possible by taking advantage of every chance for a scenic view and of artistic effects in general.

The surfaces of such roads need not be of the kind dictated by heavy business traffic in the congested areas. As long as vision is preserved, both vertical and horizontal, a large amount or easy curvature can and should be used, and distance, within reasonable limits, is quite immaterial if the bulk of the traffic is tourist traffic.

Even in such areas, however, we must be careful to realize that while in certain seasons the tourist traffic seems to be all the traffic, it is a short-time proposition, and if the total traffic were counted throughout the year we would often be astounded to find that the local use of the highways throughout the year so closely approximated, or in many cases surpassed, the tourist traffic, which we deem to be the only factor in the situation, and consider to the total exclusion of the factor of local all-the-year-around traffic.

Tourist Traffic Forces Higher Type Construction

As to the interest of tourst traffic on the maintenance programs of states, the tourist traffic will influence these programs in so far as it is a percentage of the total maximum traffic on any road. It will, in many cases, force the construction of roads of a higher type than the local needs would demand because of its severe demands on low type roads at certain seasons. It is possible, for instance, to maintain gravel roads under certain weather conditions up to a certain total traffic per day without surface treatments and with general satisfaction to the traffic. But if this traffic is vastly increased during certain periods it is necessary from the standpoint of road surface and of public safety (on account of dust), to either build a higher type road or to surface treat the inferior type. It is probably not often that a surface treated gravel road is the truly economical type, and therefore where surface treatments are impelled by tourist traffic the construction of more permanent types of surfacing may be impelled.

Naturally the increased traffic, due to tourist business, produces increased maintenance costs in some cases. However, these increased maintenance costs due to tourist traffic on certain specific stretches are a very small portion of the total maintenance program of any state which is maintaining a statewide road system, and can probably be practically disregarded in a study of the economics of real all year around service to traffic.

Marking the Roads

It is in the third field of a state's highway activities that the influence of tourist traffic can clearly be recognized, and even in this field, while special efforts must be taken to take care of tourist traffic, the total cost of this care is again negligible as compared to the whole cost of a state's highway program.

Long distance traveling imposes, or should impose, upon states the responsibility for directing and properly taking care of this traffic. This direction should, in our opinion, take the following forms:

Abstract of a paper presented at the annual convention of the American Road Builders Association, Chicago, Jan. 16-19.

1. A logical marking between logical destinations of the main arteries of traffic with a number.

2. The publication of a map showing the type and numbers of the main highways, so that there may be selected from the map the numbered route to follow, so that all that remains is to pick up the numbers on the ground and follow them to the desired destination.

Points 1 and 2 include the Wisconsin system of road marking and numbering, originated by the author of this paper in 1917, and which has since been adopted by many other states as their standard, and by some foreign countries as well.

These maps should be published by the state at a reasonable price, and arrangements made to sell them through the customary channels of trade on such terms as will induce every store handling highway maps to handle these state official maps. We have found it possible in Wisconsin to publish a very adequate map so that it can be sold to the ultimate consumer for 20 cents a copy.

3. A detour service consisting of maps indicating the detours and roads under construction corrected at least weekly.

Issuance of such a map was started in Wisconsin in 1921 and its success was instantaneous. These maps are sold at a minimum figure to public places throughout the state and from these maps all travelers can determine the route which they should take to encounter the minimum difficulties on any given day. The big service which they perform is in keeping the traffic away from those lengths of road along which it is especially difficult to maintain traffic adequately. Their principal service is to tell the traveler what roads to keep away from, and for this service they are invaluable.

4. A thoroughly consistent system of marking and maintaining, not only the system covered by the numbering and marking, but all detours from this system.

It is in this field of detour service that probably the most signal help can be rendered to tourist traffic. No trouble or expense should be spared in making this detour service, both in maps and in actual performance on the road, the most adequate possible.

Cost of Detours

One of the largest items of cost in the construction or maintenance of roads is the cost of detours, and if our people can be brought to realize that included in the cost of construction there must be included the cost of making detours, we would advance much more rapidly in the public demands for this service.

5. The state highway department should maintain, not only at the central office, but at all division offices, traffic information bureaus.

These bureaus should be supplied with maps giving the latest data as to the travelability of all roads, so that all who care to visit these offices or to call them up may be given absolutely reliable information as to teh road conditions which they will encounter on any trip, and also directions how to best avoid the difficulties in the way of the trip on that especial day.

This involves a knowledge, not only of detours and detour conditions, but of surfacing conditions as modified by the recent, present, and expected weather conditions.

6. In addition there should be available for use by commercial organizations, banks and business houses, well thought out maps of various scales, furnished to these houses at cost, so that there may be the most widespread publicity of the touring routes and their condition in a given state.

The curse of the country has been poor and prejudiced map service. It is our contention that, within reasonable limits, a state cannot make a mistake in furnishing the maximum kind and number of highway maps needed for all types of highway map service.

Traffic Direction an Essential Service

All the above includes traffic service, unknown ten years ago, but it is a traffic despatching service which is absolutely essential in the proper conduct of the highway traffic of any state. The time has gone by when the states can afford to have a myriad of motorists seeking blindly to find their way. It is expensive, it is unnecessary, and it produces a loss of time, money, and morals not compatible with modern progress.

The traffic must be directed, not only for its own advantage in saving in time and money, but for the advantage of the state and county highway departments in keeping traffic off of roads where it would be inconvenienced and also inconvenience construction and maintenance operations.

The key word of this modern type of highway traffic direction is service. It cannot be carried to excess, because its costs, as compared with the total cost of the highway program of a state, is almost infinitesimal, no matter on what broad lines it may be projected and carried out.

The writer feels that in the matter of type and methods of construction and in the matter of character and methods of maintenance, the highway engineering profession has quite well mastered the subject matter. We have not reached perfection, but we have caught up with the varying demands for construction and maintenance, and are, in a great majority of instances quite adequately building and maintaining roads.

We are much further behind in the item of traffic service than in any other item. There is still too much of the feeling that traffic is an interloper, which has no business to be there to interfere, especially with construction operations. It is our conception that traffic is the "boss" which employs us to give it service, and that we are not the masters in this matter, but the servants, and anything we can do to give service is nothing more than is due to the master traffic.

The people appreciate this kind of service, they know that it means dollars to them, and more than dollars, it means comfort, convenience, safety and speed in their travels. The American public is going to insist upon more and more of it, and it behooves all who are connected with highway development, whatever the unit of government they serve, to recognize this demand and to meet it.

The Dunes Highway

(Continued from page 136)

on hard surface highways. In Illinois and Wisconsin the road is known as Sheridan Road; in Indiana as the Dunes highway, and at the Indiana state line it connects with Michigan State Road No. 11.

With the wonders of the Dunes, greatness of the Michigan fruit belt and the interest of the Wisconsin section, the Dunes highway forms the connecting link which will become increasingly popular as the public realizes the possibilities for a trip across the same between Illinois, Indiana and Michigan.

Progressive Construction of Highways

(Continued from page 135)

reputation for having a remarkable system of dirt roads—remarkably good under favorable weather conditions and remarkably muddy during rainy weather. Still but little surfacing work had been undertaken, road building efforts and revenues as yet being devoted to the building of earth roads and substantial bridges and culverts, with here and there a few rather desultory attempts at gravel surfacing.

The coming of federal participation in highway building necessitated further changes in Iowa's highway laws. Such changes were brought about during the legislative sessions of 1917 and 1919. A further classification of highways was made, a limited trunk line system of approximately 6600 miles being designated as the Primary Road System, upon which all Federal Aid allotted to the state, as well as all revenues derived from the licensing of motor vehicles, must be expended. The remaining mileage of highways was classified as secondary roads, approximately 11,000 miles of which constitute the county road system, and the remaining 87,000 miles still being under the supervision of the township officials.

The Primary Road Fund

Under this revised legislation the policy of progressive construction persists. The Primary Road Fund—Federal Aid and revenues derived from the licensing of motor vehicles—is divided among the various counties of the state in proportion to their area, providing a fund of approximately $90,000.00 annually to the average county for improving and maintaining approximately sixty-seven miles of primary road. Obviously this fund is not sufficient to make possible any considerable progress in building roads having a high type of surfacing, and except in those few counties that have taken advantage of a provision of the law which allows anticipation of future allotments of Primary Road funds through the issuance of county bonds, the improvements undertaken on the primary road system consist largely of completing the construction of roads to established grade, providing the necessary drainage and drainage structures, and when this has been completed, surfacing with gravel or sand-clay construction. In addition to the inadequacy of funds heretofore mentioned as restrictive to a paving program, the law imposes further restrictions in requiring the question as to whether or not the primary roads of a county shall be hard surfaced to be submitted to a vote of the people of the county. The further provision that when hard surfacing is authorized, 25 per cent. of the cost thereof is assessed to abutting and adjacent property, acts as an additional deterrent in getting a hard surfacing program under way.

Accomplishments toward the improvement of the primary road system since its establishment are therefore largely along the line of progressive construction. On December 1, 1922, of the 3653.5 miles of the primary road system that had been constructed to established grade and the necessary drainage and drainage structures provided, 334.4 miles had been paved and 1558 miles had been gravel surfaced, leaving 1761.1 miles without surfacing of any kind. A large percentage of the mileage that has been gravel surfaced will need to be paved some time within the next decade if traffic is to be adequately served. In the meantime, however, traffic on these 1558 miles of gravel surfaced highways is getting reasonably efficient highway service, whereas the same funds invested in pavement would have given traffic a high grade of highway service on only approximately 150 miles.

It will thus be seen that up to the present time road building in Iowa has been hedged about with restrictions that make any policy other than that of progressive construction entirely impractical. Neither is it believed that Iowa is the loser on that account, nor that the opposite policy of highway improvement, that is, the concentration of available highway revenues upon a limited mileage of high type roads, would have given traffic upon the highways in Iowa a service comparable to the service that has been given. The dirt roads that have been constructed to established grade and the necessary drainage and drainage structures provided, give vastly better service than do the ungraded, undrained, and poorly bridged highways. Also, the highway that has been graded several years in advance of the time that it is to be hard surfaced is in much better condition for hard surfacing than is a newly graded highway, particularly so in locations where the topography is rolling. To hold to 6 per cent. maximum grades on some primary roads in Iowa requires upward of 30,000 cu. yd. of earthwork per mile. Experience teaches that the resulting fills under these conditions require two or three years to become stabilized and that a rigid type of surfacing should not be attempted on these fills until they have become thoroughly stabilized.

In conclusion, it may be said that the policy of propressive construction of highways in Iowa is a logical result of its traffic needs and its highway laws, which after all are in a measure reflective of traffic needs. Under this policy, substantial progress has been made. If highway traffic is to be given anything like the service it deserves, however, there must be no undue hesitation about taking the suceeeding steps so necessary to the success of such a policy. Based on present costs, at least one hundred million dollars must be spent during the next five years on constructing and maintaining the primary road system alone, if traffic is to be only reasonably well served. An equally large expenditure should be made during that period on secondary highways. It is not a case of the state not being able to afford such expenditures; rather it is a case of the state not being able to afford to do without the highway service that will result from such expenditures.

Flow of Water Through Culvert Pipe

(Continued from page 133)

all the data for the experiments mentioned here, and also observations on various forms of piezometer connections, curious effects on the hydraulic gradient when the outlet is discharging freely into the air, and means of recovering and utilizing the velocity head at the outlet end of the pipe.

The tests were carried out by David L. Yarnell, Senior Drainage Engineer of the Bureau of Public Roads, and Professor Floyd A. Nagler, State University of Iowa, who is in charge of the hydraulic laboratory. Sherman M. Woodward, Professor of Mechanics and Hydraulics, State University of Iowa, acted in an advisory capacity. The entire investigation was under the general direction of S. H. McCrory, Chief, Division of Agricultural Engineering, Bureau of Public Roads.

Current Events in the Field of Highway Engineering and Transport

U. S. GOOD ROADS ASSOCIATION TO HOLD SHOW AND CONVENTION APRIL 16-21

The coming meeting of the U. S. Good Roads Association, Bankhead National Highway Association and U. S. Good Roads Show to be held in Greenville, S. C., during the week of April 16-21, promises to be the greatest gathering of enthusiastic crowds that have ever assembled in America, judging by the correspondence that is pouring into the headquarters of these organizations, which are in charge of Director General J. A. Rountree. Every mail brings inquiries about hotel rates, hotel accommodation and rooms, railroad rates and exhibit space at the show. Already the assurances have been received of a large delegation from Alabama, Arkansas, Georgia, Mississippi, Florida, Texas, Tennessee, Maryland, Virginia and North Carolina, as well as the state of South Carolina, which will furnish large crowds of enthusiastic good roads boosters who are anxious to show their wonderful country to the visitors from the other states, and to receive inspiration in regard to road building.

Every mail brings the appointment of delegates by Governors, County Highway Commissioners, Chambers of Commerce and Automobile Clubs. Each of these delegates are receiving a personal letter from Director General Rountree, giving them full information about Greenville, the convention and the show, and urging them to attend. The U. S. Good Roads Show will be an education within itself as there will be numbers of exhibits of machines, and machines in demonstration. The latest machinery models of trucks and automobiles will be on exhibition.

The Greenville Chamber of Commerce is appointing the various committees and are perfecting plans to give the members, delegates and visitors a royal time when the convention meets. Many unique entertainments and automobile drives are being planned.

Director General Rountree who has been in Greenville for the past four weeks is perfecting plans, sending out literature, writing letters and arranging the details of the convention and is very much gratified with the progress that has been made and the success that has been achieved.

TEXAS BUILDS 2639 MILES OF ROAD IN FOUR YEARS

Since the year 1917 there have been constructed in Texas, according to J. D. Fauntleroy, state highway engineer, 2,639.53 miles of new highways at a total cost of $27,606,161.46. There are under construction at present 1,844.16 miles of highways, estimated to cost $25,679,698.01. This spring contracts will be let for 619.10 additional miles to cost $12,211,354.04. When these 619.10 miles of highways are completed the work done on the Texas highway system since 1917 will embrace 5,102.79 miles of improved roads at a total cost of $65,497,213.51.

The roads built in Texas are not all of the cheaper types but include asphalt and brick roads, as well as gravel and sand clay. Texas construction also includes approximately 1100 bridges ranging in length from 22 to 8000 feet. The State highway department also secured the elimination of 161 dangerous railroad grade crossings.

MISSOURI NOW HAS 46,311 MILES OF IMPROVED ROAD

Missouri now has 46,311 miles of improved road not including that added during last season, according to the U. S. Bureau of Public Roads, which has made a complete census in the State. The improved road mileage at the beginning of 1922 was as follows:

Graded and drained	38,431
Sand-clay	1,755
Gravel, chert, and shale	4,510
Water-bound macadam	1,329
Surface treated macadam	56
Bituminous macadam	104
Sheet asphalt	1
Bituminous concrete	12
Cement concrete	103
Brick	10

The total road mileage of the State is 111,521, as compared with 96,041 miles in 1914, and during the seven-year period from 1914 the surfaced and paved roads have increased from 6,713 to 7,880 miles.

LINCOLN HIGHWAY IN EAST IN GOOD SHAPE

Although most of the main traveled roads in New England and New York State are still not ready for automobile touring, there are other roads leading South and West from the metropolitan district which are entirely passable, provided that care is taken to stick closely to the main thoroughfares. The Lincoln Highway to Philadelphia is in very good condition, with the exception of about a mile just below Metuchen and another short stretch on entering New Brunswick, where concrete is to be laid. At these points one side of the road is completed, and the other side will be completed as soon as weather conditions permit. However, traffic is going through in both directions without any trouble.

The best route to Atlantic City at the present time is via the Lincoln Highway to Trenton, and then by way of White Horse and Burlington to Camden, and then on the White Horse Pike, which is a new concrete road direct to Atlantic City.

Road conditions throughout New Jersey are found to be in fairly good condition for this time of the year, although many of the State roads have large and dangerous holes which are the scars that come with winter. However, all State roads are passable, but one will find the going very heavy over the gravel roads, but with continued fair weather it will give the Highway Department an opportunity to free the roads of ruts and other obstacles.

MASSACHUSETTS SPENDS $9,000,000 FOR ROADS DURING 1922

During the year 1922 the State of Massachusetts spent a total of $9,000,000 for the improvement of its highways. A total of more than 212 miles was constructed or reconstructed, the mileage being approximately the same as in the year 1921. Of this 32 miles were of cement construction, 78 miles were of bituminous macadam with asphalt, 21 miles were of bituminous macadam with tar, 16 miles were of bituminous concrete, 2½ miles were of waterbound macadam, and 62 miles were of gravel. A small portion of the work had been started in 1921. Massachusetts also reports the remarkably low maintenance cost of one-half cent per square yard equal to $52.80 per mile of sixteen foot road for its large mileage of asphalt macadam pavements.

JAPANESE OFFICIALS INSPECT AMERICAN ROADS

That the new government in Japan is planning a comprehensive road building program, is the statement of Count Y. Hosono who has been visiting America for the purpose of studying our methods of constructing asphalt streets and roads. Count Hosono came to this country as the official representative of the Japanese government, as did Dr. Hikoschiki Maki, highway engineer for the Government of Japan, director of the National Laboratory for Testing Road Materials, member of the Imperial Japanese Road Council and Secretary of the Japanese Good Roads Association.

Another Japanese government representative who has been in this country recently studying American asphalt road paving was Prof. Takakuwa of Kiriu University at Tokio, who returned to Japan, very enthusiastic over American highways. Dr. Maki stated while in New York that the Japanese government has just made its first appropriation of $10,000,000 for good roads, the funds to cover construction and maintenance for a short period of years. Dr. Maki spent some time investigating the nature and activities of American good roads organizations and gathered considerable data to be used in reorganizing and extending the work of the Japanese Good Roads Association.

FOREST HIGHWAY CONSTRUCTION BIDS TO BE OPENED APRIL 20

The District Engineer, U. S. Bureau of Public Roads, Phoenix, Arizona, announces the opening of bids for Forest Highway Construction, as follows:

On April 20th proposals will be received for the construction of the Cancito-Pecos Forest Highway, located in the Santa Fe National Forest, Counties of Santa Fe and San Miguel, State of New Mexico. This project is 11.448 miles in length, involving moving 114,00 cubic yards of rock and common excavation, placing 3,192 lineal feet of corrugated metal pipe, pouring 1,420 cubic yards of concrete, and laying 35,138 cubic yards of Water-bound Crushed Rock or Gravel Surfacing. The total estimated cost of construction is approximately $187,000 and the project must be completed within 250 weather working days.

On or about May 1st, it is expected that proposals will be received for the construction of the Prescott-White Spar Forest Highway, located in the Prescott National Forest, Yavapai County, Arizona. This project is 18.091 miles in length, involving moving 446,170 cubic yards of unclassified excavation, placing 13,126 lineal feet of corrugated metal pipe, placing 3,105 cubic yards of concrete, with 194,000 lbs. reinforcing steel. The total estimated cost of construction is approximately $448,900, and the project must be completed within 450 weather working days.

CALENDAR OF COMING MEETINGS

AMERICAN ASSOCIATION OF ENGINEERS, Annual Convention, Norfolk, Va., May 7-9.

AMERICAN SOCIETY OF CIVIL ENGINEERS, Spring Meeting, New Orleans, La., April 18-20.

AMERICAN SOCIETY FOR TESTING MATERIALS, Annual Meeting, Atlantic City, N. J., June 25-29 or 30.

BIG INCREASE IN MOTOR VEHICLES IN 1922

In 1922 motor vehicle registrations more than maintained the rate of rapid increase which has caused the total registration to grow from 3,500,000 in 1916 to 12,238,375 motor cars and trucks at the end of 1922, says the U. S Bureau of Public Roads. Last year the increase amounted to 1,775,080 registrations, as compared with an average yearly rate of approximately 1,390,000 for the preceding five years.

The table issued by the Bureau gives registrations by states which total as follows for the whole United States:

Private passenger cars...	10,890,112
Taxicabs, busses, and cars for hire	69,459
Motor trucks and commercial cars	1,278,804
Trailers	29,328
Motor cycles	182,714

A comparison of the truck registration figures with those for the preceding year shows an increase of 30 per cent., indicating that this phase of highway transport is undergoing rapid development. The increase in truck registration is not confined to industrial sections. Such agricultural states as Virginia, Indiana, and Florida show increases of 33 per cent., 30 per cent. and 29 per cent. respectively which seems to indicate that many farmers are changing their method of hauling as a result of road improvement.

The total gross registration revenue amounted to $152,047,823, of which $117,093,116 was applied to road work under the supervision of the state highway departments. Eighteen states taxed gasoline, deriving a revenue of $11,923,442, not all of the states reporting for a full twelve-month period. Of this amount $6,474,178 was spent under the supervision of the state highway departments.

FIRESTONE GOOD ROADS ESSAY CONTEST TO CLOSE ON MAY 1

High Schools Again Prepare to Submit Essays in Annual Good Roads Competition

For the fourth successive year high school students of the nation are to be given opportunity to win the largest single educational award offered in the United States. The award is the H. S. Firestone Four Years University Scholarship, providing not only tuition, but room, board, books and special fees for the student writing the best essay in the annual good roads essay contest. The assigned subject of the essays to be written is "The Influence of Highway Transport Upon the Religious Life of My Community."

Announcement of the contest is being made to superintendents of schools, high school principals, and students as rapidly as possible, and all available literature is being listed and tabulated for the information of the prospective contestants. The Highway Education Board, under whose auspices the contest is conducted, announces its willingness to answer any inquiry students and teachers may desire to make, but it points out that all that is necessary is compliance with the simple rules of the contest, and the preparation of a 700 word essay on the subject. Essays should be submitted to the high school principal by May 1.

The contest, known to thousands of students throughout the United States and territorial possessions as the "Annual Good Roads Essay Contest," is the most sustained competition of its kind. Inaugurated in 1920, it has provided a college education for three students, one boy and two girls, and its maintenance from year to year is assured by the donor of the scholarship, Harvey S. Firestone, Akron, Ohio.

This year the subject is regarded as unique and unusual, bringing up for discussion the relation of improved transportation to the moral tone or the religious life of the community. Leading churchmen have expressed their approval of the discussion the essays are to bring about, while distinguished educators have given their approval to the contest itself. In past years the subjects have been broader, and more general, the subject for 1922 dealing with the improved transportation and the growth of the community as a whole.

Previous winners have been Miss Katharine F. Butterfield, Keiser, Idaho, 1920; Miss Garland Johnson, Bridgeport, West Virginia, 1921, and in 1922, Karl G. Pearson, Washington, District of Columbia. Miss Butterfield is in college, but Miss Johnson and Mr. eParson, not being seniors when the scholarship was awarded them, have remained in high school until their courses are completed. They both will enter college this year, Miss Johnson at the University of West Virginia, and Pearson at a university in Kansas, his home state.

The best three essays from each high school are t be submitted to state headquarters, where the best essay from the commonwealth will be chosen. One essay from each state and territory will then come to the Board at Washington, D. C., there to be handed to a national committee to be named by Dr. John J. Tigert, U. S. Commissioner of Education. The national committee will award the scholarship.

Inquiries should be addressed to the Highway Education Board, Willard Building, Washington, D. C.

CONFERENCE OF ROAD OFFICIALS HELD IN PENNSYLVANIA

Representatives of 25 States Met to Discuss Highway Problem

Selection of road types with some idea of the use to which the road will be put, removal of State Highway departments from politics, a tax on gasoline, so road users will pay for road construction and maintenance in direct ratio to the extent they use roads; a traffic survey in each state, uniform motor legislation, and elimination of all grade crossings are recommended to the American people by the delegates attending the highway conference recently called by Governor Gifford Pinchot.

Road officials from 25 states met in Harrisburg and for two days discussed highway problems. To summarize the conclusions of the conference a committee was named chairmaned by Thomas H. MacDonald of Washington, chief of the Federal Bureau of Roads. Other members were Col. Frederick Stuart Greene, highway commissioner of New York; Chief Engineer A. W. Dean of the Massachusetts Highway commission; Frank Page, chairman, North Carolina Highway commission; Paul D. Sargent, chief engineer, Maine; Clifford Older, chief engineer, Illinois; H. G. Shirley, chairman of the Virginia Highway commission; Charles J. Bennett, commissioner, Connecticut, and William H. Connell, assistant state highway commissioner of Pennsylvania.

The report of the conclusions committee is as follows:

Administration

The construction, maintenance, financing, and operation of highways is becoming more and more a question of nation wide transportation and less one of neighborhood convenience. There are two general phases to every problem coming before a state highway department for solution—the business and the technical. A majority of the states have recognized this fact by providing for either engineer commissioners or technically trained engineer executives. We believe this principle is sound fundamentally and urge the state authorities, both executive and legislative, to provide at all times strong engineering control in the administrative and executive work of their state highway departments and engineering supervision of the construction, maintenance and operation of the highway systems.

To this end we urge that these departments be removed from political influences, and that continuity of service be preserved for a sufficient period to insure stabilized policies. In no other way is it possible to safeguard and protect the interests of the citizen who is paying for the roads.

State highway departments, with their knowledge of the geography and topography of the states, should determine without legislative or other interference what roads or systems of roads should be constructed and maintained with state funds and should not be governed by legislation as to types and cost of construction.

Finance

The highway departments should be operated under a budget system.

The cost of building and maintaining an adequate system of highways should be distributed equitably among the sources of highway revenue in proportion to the benefits derived from the improvement.

The permanent features of original construction of highways should be financed on the "pay as you go" plan or from the proceeds of serial bonds, according to the stage of development of the highway system now existing in the several states.

The policy of requiring the user of the roads to pay for the service received through a license and gasoline tax is a sound one, and all revenues from such sources should be applied primarily to the maintenance and reconstruction of highways.

Construction

Owing to variations in climate, soil, traffic conditions and available materials, no one standard type of pavement is practical for the country or even for a state.

Granite block, brick and bituminous tops on a concrete foundation, and a concrete pavement may be termed as construction of the first class; the so-called flexible types of pavements may be termed as construction of the second class; and gravel, sand and clay or other top soil may be termed as construction of the third class.

The progressive method of construction, whereby the grading, structures and drainage are first completed and the hard surface pavement laid later, is both a practical and at times the most advantageous method of highway construction.

Maintenance

Unless adequate maintenance is provided for, initial construction of highways should not be undertaken at all.

The same engineer who builds the road should be held responsible for its upkeep.

Traffic

Each state highway department should establish a traffic bureau to make a highway transport survey in all its phases to determine present, and forecast future, traffic conditions to assist in the selection of the economic road construction.

Efforts should be made, in co-operation with motor vehicle officials, to establish as soon as possible uniform motor vehicle laws and regulations, so that the user of the road may travel under uniform laws wherever he goes.

It is highly desirable that a uniform law be enacted by the states of the union regulating the dimensions of motor driven vehicles and the wheel load of such vehicles.

An effort should be made to provide proper standard devices for the protection of the road user and the prevention of accidents, and no person should be allowed to operate a motor-driven vehicle upon a public highway until such driver has been examined and a license showing competency has been granted.

We believe in the installation of simple, easily followed direction signs.

A more determined effort should be made to promptly eliminate all grade crossings.

Realizing the grave responsibility resting upon the officials charged with the administration of the highways for the safety of the public, we earnestly appeal to the people at large to aid in making these conclusions effective.

Equipment—Trade—Materials

LAKEWOOD STEEL SUBGRADER

Another new unit of paving equipment introduced this year, which is meeting with general approval of contractors, is the Lakewood Steel Subgrader, which is a development of the Lakewood wood frame Subgrader which has been used for the past several years and has proved of such advantage to both contractors and engineers that mechanical subgrading is rapidly becoming the standard method.

The steel Subgrader has been developed to meet the demand for a heavier unit, and one which could be equipped with scarifying teeth on the front member to assist in breaking up the subgrade ahead of the blades. The wood frame Subgrader will still be furnished, but the steel tool will be supplied to contractors desiring a stronger and heavier machine.

The machine will cut to either a flat or crowned subgrade and can also be adapted for the new Illinois design of subgrade, which provides for a slab considerably thicker at the edges than at the middle. A turntable pedestal allows the machine to be raised off of the forms and turned in the middle of the road to allow the roller or trucks to pass.

WEHR ONE-MAN ROAD GRADER

Much interest is being shown by city officials, road commissioners and contractors, in tests which recently have been conducted with the Wehr One-Man Power Grader. This ingenious machine is a combination of a road grader with a 6 ft. blade, directly connected to the Fordson Tractor. The front wheels and tractor axle are removed and the grader frame is connected to the tractor so that the outfit can be controlled and operated under all conditions by one man.

The city of West Allis, Wisconsin, has been using a Wehr One-Man Power Grader on both road work and for clearing snow with remarkable economy. The Commissioner of Streets reports that he has been able to save the work of three men and six horses with one of these Wehr outfits. Several municipalities are keeping cost records to determine actual operating charges over a period of time.

The grader blade can be raised quickly, lowered or swung to either side and at any angle by the operator. The tractor clutch and gears are manipulated from the operator's platform by means of hand and foot levers.

To assemble the Wehr grader and Fordson Tractor requires only an hour as there are no holes to drill, simply a matter of removing tractor axle and wheels and suspending the tractor in the yoke of the grader.

The grader is built entirely of steel with electric steel castings wherever strength is required. It is fully patented, the first patent having been issued on December 6th, 1921, with other patents pending. Full information will be sent to any one who is interested by addressing the Wehr Company, 533 Thirtieth street, Milwaukee, Wisconsin.

A CENTRAL PROPORTIONING PLANT THAT KEPT PACE WITH A TRAIN

A central proportioning plant that kept pace with a train! This unique performance is one of the big reasons for the success made by R. D. Baker Company of Detroit on their road contract at Cochranton, Pa. And it was the Blaw-Knox Batcher plant that did the work—not a specially designed apparatus, but just the standard 30-ton Blaw-Knox Bin with Blaw-Knox Measuring Batchers.

At the time, conditions for road building were anything but favorable. Railroad facilities were poor and truck roads in bad shape. The contractors could not afford to risk delay in shipments due to freight on shortage. Their problem was solved by the adaptability of the Blaw-Knok Batcherplant.

All aggregate was stored in a pile 1000 ft. long. Parallel with this pile, a short section of track was laid and along this track the contractor moved his batcherplant mounted on wheels. By this method the bin was always close to the material and was kept filled with the least difficulty.

Materials were carried from bin to mixer in a train of hopper cars. The aggregate had to be proportioned for two types of road—one of concrete and the other bituminous surface on concrete, in mixes of 1:2:5 and 1:1½:3—

the Blaw-Knox Batchers were easily adjusted to measure off the necessary quantities.

Once set, the batchers worked with their usual accuracy and speed, so that only one man was required to operate the entire proportioning plant. By pulling a lever he releases the flow of material into the batchers and then by pushing back the same lever the material flow is shut off and struck off at the same time, leaving in the batcher the exact amount called for by the specifications. A pull on the rope and the material is dumped. As soon as the batcher is empty, the drop gates close automatically and the operator is started on the next batch.

At this rate the stock pile was soon exhausted and the Batcherplant was put to a test of portability—with remarkable results. It was moved to a second and again a third set-up. One of these was for a distance of 2 miles and the other for 10 miles. In spite of bad roads and a grade that reached 12 per cent. in some places, the 10 miles were covered so quickly that the Batcherplant was ready for operation in its new location just 5 hr. after it was removed from the first set-up.

This job was one of many on which the Blaw-Knox Batcherplant has enabled the contractors to overcome difficulties and increase their profits. The speed, the accuracy, the "all-set, let's-go, no-stop" regularity of the Batcherplant, places it in a class by itself as a boon to the builder of real roads.

Blaw-Knox Batcherplants are manufactured in three standard types—the Trussed, Suspension and Charging Bins. The Trussed Bin is so called because of the interchangeable unit trusses which support the bin; it is furnished in capacities of 65-ton, 116-ton and 186-ton units, designed particularly for truck hauling and central mixing plant. In the Suspension Bin, the storage container is suspended on heavy columns and pillars and is standardized in units of 30, 50, 75 and 100 tons, with additional 25-ton units and is especially adaptable for industrial hauling and central mixing plant. As indicated by its name, the third type is used for charging trucks or batch boxes, chutes, hoppers, etc., and has a storage capacity of six cubic yards or nine tons.

Sand and gravel dealers also recognize the value of the Batcherplant, both as a storage bin and measuring device, and indications are that this apparatus will become standard equipment in all work that necessitates the storage and measuring of sand, stone, gravel and similar materials.

Recent Publications

American Engineering Standards Committee Issues Year Book

The American Engineering Standards Committee has just issued its Year Book for the year 1923. It contains a resume of the outstanding developments in standardization work during the year 1922 and describes in some detail the method of work and co-operative efforts with the various engineering departments of the government, foreign standardization bodies and other organizations. Those interested in standardization work may obtain copies of the book by applying to the American Engineering Standards Committee at 29 West 39th street, New York City.

Asphalt Association Issues Pocket Reference for Engineers

The Asphalt Association has just issued Brochure No. 14, dealing with the salvaging of old pavements by resurfacing with asphalt, and also a pocket reference for engineers which contains definitions, test methods, condensed specifications, and other paving data pertaining to asphalt construction. Both of these publications may be obtained without cost by application to the Association at their New York office, 25 West 43 street.

"The Explosives Engineer." A New Journal

The Hercules Powder Co., has just published No. 1 of "The Explosives Engineer" a magazine to be devoted solely to the industrial uses of explosives and related topics. The first issue contains articles by N. S. Greensfelder on "Uncle Sam's Explosives Engineers;" J. Barab on "Scientific Quarry Blasting," and D. E. Dunn on "Rock Drills and How to Use Them."

The Vulcanite Portland Cement Company Publish New Bulletin

The Vulcanite Portland Cement Co., has just issued an illustrated bulletin, "What Contractors Say About Us," which contains facsimile letters from the users of this particular product.

Proceedings of National Lime Association Convention Available

The National Lime Association recently published the proceedings of its Twentieth Annual Convention, held in the Hotel Statler, Cleveland, Ohio, last June 13th to 16th. It is a book of 104 pages and contains the papers presented at the convention and the discussions in connection therewith. Copies may be secured by addressing the Association at its Washington office, 918 G street N. W., Washington, D. C.

New Catalogue of American Cement Machine Co.

The American Cement Machine Co., of Keokuk, Iowa, has just published a 28 page catalogue describing their heavy duty type of Boss Mixers. It contains illustrations and descriptions of all of the important details of this well-known line of mixers as well as technical data and specifications. The company will be pleased to furnish a copy of this catalogue to any one who is interested.

Highway Education Board Issues Proceedings of Second National Conference

Under the title "Education for Highway Engineering and Highway Transport," the Highway Education Board has just issued the proceedings of the Second National Conference held in Washington, D. C., on October 26th, 27th and 28th. It contains not only the papers presented at this conference but also committee reports and a list of the delegates in attendance. Copies may be obtained upon application to the Board at its office in Washington, D. C.

Continental Pipe Manufacturing Company Put Out New Catalogue

The Continental Pipe Manufacturing Company has just issued a 248 page cloth bound catalogue. It contains in addition to numerous figures showing installations of various types of its product a complete series of tables covering all phases of the flow of water through pipes and flumes of all dimensions. This catalogue is known as No. 18.

Personal Mention

Major Frederic E. Wheeler, formerly president of Finlay-Wheeler, Inc., contractors equipment dealers of Buffalo and Rochester, N. Y., has joined the Chicago sales staff of Blaw-Knox Company, manufacturers of road builders equipment, clamshell buckets, steel forms for concrete construction, Prudential sectional steel buildings, transmission towers and other steel products.

* * *

Mrs. Ruth Kramer of Carrollton, Georgia, who was with the pathfinding tour establishing the Bankhead National Highway, will head an automobile caravan from Washington to the annual meeting of the U. S. Good Roads Association and the Bankhead Highway Association, which will be held at Greenville, S. C., April 16-21. The caravan will leave the zero milestone on April 12th and will be joined by automobiles from different cities en route.

Another motor caravan will come from the West from Memphis and the delegates in addition to the business meeting will be taken over to Asheville, N. C., and to the top of Mount Mitchell, the highest point east of the Rockies. They will also visit the famous Chimney Rock in western North Carolina.

The A. A. A. is preparing a special map and routing for Mrs. Kramer's motor caravan and a special representative will accompany the party.

HIGHWAY CONTRACT NEWS

Montgomery, Ala.—Bids will be received by the State Highway Commission of Alabama at the office of the State Highway Department, Montgomery, Alabama, until April 17, for the construction of 13.537 mi. of road beginning at the Dale County line and ending approximately one mile south of Louisville, in Barbour County. The principal items of work are approximately as follows: 12.42 acres clearing and grubbing, 86,128 cu yd. common excavation, 100 cu. yd. solid rock excavation, 4,522 cu. yd. gravel surfacing one mile haul, 35,460 cu. yd. sand-clay surfacing one mile haul, 940 lin. ft. 18 in. pipe, 427.5 lin. ft. 21 in. pipe, 106.68 cu. 7d. class "B" concrete, headwalls and inlets, 118.62 cu. yd. class "A" concrete culverts, 9,342 pounds reinforcing steel, culverts, 94 concrete guard rail posts, 176 concrete R. O. W. Markers. Address W. S. Keller, State Highway Engineer.

Montgomery, Ala.—Bids will be received by the State Highway Commission of Alabama at the office of the State Highway Department, Montgomery, Alabama, until April 17, for the construction of a road beginning at the Barbour County line and extending 11.797 mi. to Abbeville in Henry County. The principal items of work are: 2.02 acres clearin gand grubbing, 70,302 cu. yd. common excavation, 7,405 cu. yd. gravel surfacing 1 mile haul, 9,500 cu. yd. gravel surfacing ½ mile add. haul, 27,000 cu. yd. sand clay one mile haul, 1281.5 lin. ft. 18 in. pipe, 297.5 lin. ft. 24 in. pipe, 48.71 cu. yd. class "A" concrete culverts, 125.55 cu. yd. class "B" concrete headwalls, 154 concrete R. O. W. markers, 73 concrete guard rail posts. Address W. S. Keller, State Highway Engineer.

Springfield, Ill.—Bids will be received in the office of the State Department of Public Works and Buildings, Division of Highways, Springfield, Ill., until April 13, for the road work designated below:

Pavement Sections

Alternate bids will be received for the following types of construction: Portland cement concrete; monolithic brick (4-in. brick); bituminous-filled brick (4-in. brick); bituminous concrete with binder course (Spec. C1, C2, C3, or CT); bituminous concrete without binder course (Spec. C1, C2, C3, or CT).

Route	Sec.	County	Miles
1	11	Will	0.20
1	4	White	4.07
1	20	Crawford	4.50
1	21	Crawford	3.00
1	41	Massac	4.93
2	51	Macon	5.63
3	7	Rock Island	3.68
4	25	Sangamon	4.55
4	26	Sangamon	2.10
7	12	Bureau	3.17
7	13	Bureau	3.65
7	1-3	LaSalle	0.38
8	2-C	Warren	0.92
9	13	Ford	6.87
9	18	Ford	7.02
16	18	Christian-Montgomery	5.12
18	12	Kane-Kendall	8.12
20	13	McHenry-Lake	4.27
21	2	Lake	6.42
22	15	Will	6.25
22	16	Will, Kendall-Kane	5.19
25	28	Champaign	6.06
25	29	Champaign	4.96
25	30	Champaign	4.88
25	31	Champaign-Ford	4.86
25	32	Ford	2.74
27	1	Carrol	2.76
28	4	Knox-Henry	4.40
28	5	Henry	4.94
30	12	Stark	3.70
31	21	Fulton	5.48
32	3	Moultrie	7.96
42	113	Lake	3.91
44	19	Will	3.06

Bridge Sections

Route	Sec.	County	Type	Span Feet
17	1-B	Kankakee	1 R. C.	5@55
17	21	Kankakee	1 R. C.	5@70
42	112	Cook	3 R. C.	1@50
44	19-B	Will	1 R. C.	3@60

Address, Cornelius R. Miller, Director, State Department of Public Works, Springfield, Ill.

Springfield, Ill.—Bids will be received in the office of the Department of Public Works and Buildings, Division of Highways, Springfield, Ill, April 20, 1923, for the road work designated below:

Pavement Sections

Alternate bids will be received for the following types of construction: Portland Cement Concrete, Monolithic brick (4-in. brick); bituminous-filled brick (4-in. brick); bituminous concrete with binder course (Spec. C1, C2, C3, or CT); bituminous concrete without binder course (Spec. C1, C2, C3, or CT).

Route	Sec.	County	Miles
12	5	Richland	6.60
14	4	Franklin	5.55
25	7	Clay	3.54
25	21	Douglas	7.32
26	2	Ogle	5.62
43	1	Mason	5.20

Bridge Section

Route	Sec.	County	Type	Span Feet
12	5-B	Richland	2. R. C.	3@45

Address Cornelius R. Miller, Director, The Department of Public Works, Springfield, Ill.

Indianapolis, Ind.—Bids will be received by the Director of the State Highway Commission, at the office of the State Highway Commission, in the State House, City of Indianapolis, Indiana, until April 10, for the construction of highway No. 1 F. A. 49A. Location, Lagrange, Angola Road, Lagrange County Line, to 5 miles West of Angola, Steuben County. Bids will be received for three types of pavement—Brick ,Bituminous Concrete and Concrete on the above listed Project. Address, J. D. Williams, Director, Indiana State Highway Commission.

Baldwin, Mich.—Bids will be received at the office of the Board of County Road Commissioners, Court House, Baldwin,

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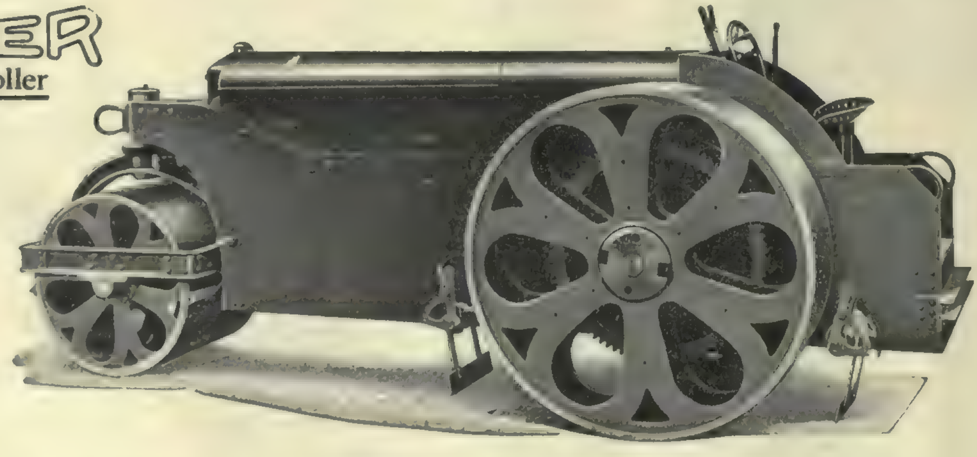

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The Journal of Highway Engineering and Transportation

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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How the Provisions of the Federal Highway Act Are Carried Out

Legislation Governing Construction of Main Interstate Roads Explained

Boiled down, the Federal Highway Act passed in 1921, and under which our main interstate roads are now being largely constructed, is a very simple proposition, according to G. S. Hoag, Field Secretary of The Lincoln Highway Association.

"The main fact to be borne in mind," says Hoag, "is simply this—that the Federal Highway Act provides for Federal aid and that the whole plan is simply one whereby the Federal Government aids the states financially in the construction of their roads." To a certain extent, therefore, the name "Federal Highway" is a misnomer. The "Federal Highways" are not Federal highways in the true sense of the word at all. They are merely state highways joining at the state lines to form routes of interstate importance and are those roads which the Federal Government will aid the states to build.

The sum and substance of it is that the Federal Government says: "We will assist each state in building seven per cent of its highways." Naturally, the Federal Government reserves the right to pass upon the selection of that seven per cent. It wishes to aid from the Federal treasury only the building of those roads which are of interstate or intercounty importance.

The procedure under the law is simple. The state highway authorities can if they wish (they are not obliged to) select a system of important roads in the state comprising 7 per cent of the total mileage of the State's roads and submit it to Washington for approval. The department of government in Washington which has this question under its authority, is the Bureau of Public Roads of the Department of Agriculture. The Department of Agriculture is headed by Henry C. Wallace, of Iowa.

When a state with a hundred thousand miles of roads, like Iowa for example, submits to the Bureau of Public Roads in Washington its 7 per cent system, or 7,000 miles of suggested roads for the approval of the Government, the Bureau studies the plan suggested, being particularly interested in how the roads connect with those in the plans submitted by the other states state connections. If some states desurrounding, in order to provide interlay in providing their suggestions to the Bureau of Public Roads, it holds up the decision affecting the roads system submitted by the surrounding states.

How States Secure Federal Aid

The procedure followed by any state desiring to take advantage of the Federal aid offered to it under the Federal Highway Act, is very simple. It differs only slightly from the procedure which the State would follow if it was going to build a road without the aid of the Government. If the road to be improved is on an important through route, construction can be undertaken whether the state system has been approved or not.

The state makes a survey and provides its plan to the Government's engineers who are governed by specific rules regulating the minimum width, grade and adequacy of type under different traffic conditions. The Government will not assist in the construction of a type or design of road-bed which will not stand up under the traffic to be carried.

If the specifications for the road come up to the Government standard, the project, as it is called, is approved by the Government through the Bureau of Public Roads and the State is assured of receiving a certain percentage of the cost of construction from the Federal Government. This percentage varies in the western states, depending upon the ratio between the area of the state and the area of the unappropriated public lands of the state. In states where the public lands amount to less than five per cent of the area of the state, the Government pays fifty per cent of the cost of construction. In a state like Nevada the Government pays over 87 per cent. of the cost of construction, due to the fact that over 90 per cent. of Nevada's area still belongs to the Federal Government and is not taxed by the State.

Assuming a project approved by the Government, the state proceeds to construct the road in exactly the same manner it would proced if no government aid were involved. It follows its own procedure which, in most instances, is to advertise for bids and let the contract to the lowest bidder. The state supervises the work, pays the contractor, and in every way proceeds exactly as it woud on an ordinary state job. The only difference lies in the fact that the Federal Government has an in-

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spector on the job to see that the specifications are followed. The Federal Government is a silent partner in the entire transaction. It does not select the road to be improved; it does not initiate the project; and it does not pay the contractor.

When the work is completed and is approved by the state highway department, the state gets its proportion of Federal aid from the United States Treasury.

In order that neither the state nor the contractor may have to carry the full expense of the work to its completion, arrangements are made whereby "progress payments" are made from time to time based on the amount of work completed, a liberal percentage being reserved to provide against contingencies.

Basically, that is all there is to the plan of Federal aid to state road building. Of course, the state cannot get Federal aid on an unlimited amount of construction. It receives financial assistance from the Federal Government on road construction up to a certain sum which in total represents that state's share of the total Congressional appropriation for highway construction. The total provided by Congress is subdivided among the states, one-third on the basis of population, one-third on the basis of area, and one-third on the basis of road mileage.

Kentucky to Build Test Road of Sandstone Aggregate

Realizing the enormous expense that must be incurred sooner or later in surfacing the roads of Eastern Kentucky, that are now being constructed as grade and drain projects without a wearing course, the question at once arises, is there any way that local sand stone can be used for the greater part of the coal fields are in sandstone formation, which occurs in thick beds and high places that would permit cheap quarying. In order to give an intelligent answer to this question, the Kentucky State Highway Commission has authorized its engineer to construct a test road made from sandstone aggregate.

Experimental work has been carried on by the State Highway testing laboratory to investigate compressive strength of concrete made from sandstone aggregate. This was thought to be the proper method of determining which of the many sand stone ledges in Eastern Kentucky will furnish a suitable material. These experiments have proven that what was formerly considered an inferior stone, can be made into good concrete by using a proper mix of cement and sandstone. The experimental work has led to a further investigation.

The test road will be approximately one mile in length and is to be divided into sections of about 400 ft., each section constructed a little differently than the other. It is proposed to build experimental road on one of the main highways in Fayette County, in order to secure a large volume of traffic over it, which will result in more of an accelerated test than if the experimental road were built in some place in Eastern Kentucky, where the volume of traffic is very much less. Another reason for locating close to Lexington is to be near a source of supply of machinery of kinds necessary to construct the various sections of surfacing contemplated. The cost to ship sandstone from the Eastern portion of the State to Lexington will be offset by the benefits derived from this location. The following paragraphs outline some of the types of surfacing contemplated for use in the experiment.

Types of Surfacing

(1) Concrete.

(a) Reinforced concrete, using a good grade of stone with stone screenings or screenings and local sand mixed. Per cent of wear, 3.0 to 5.0 per cent.

(b) Reinforced concrete, using medium grade sandstone, screenings or sand and screenings mixed, per cent of wear 6.0 to 9.0 per cent.

(c) Reinforced concrete, using soft grade of sandstone, screenings or sand and screenings mixed. Per cent of wear, 15 to 20 per cent. The mix to be whatever is shown to be best from the laboratory test now under way.

(2) Bituminous Concrete.

(a) Concrete base, with hard stone. Toy 2 in. bituminous concrete made of same stone used in base.

(b) Same as "a," but using medium stone.

(c) Concrete base, soft stone. Top 2 in. bituminous concrete, using hard stone.

(d) Broken medium stone base. Top same as "c."

(e) Same as "a" except soft stone be used.

(3) Bituminous Macadam.

(a) Hard stone for base and wearing course.

(b) Same as "a," except medium stone.

(c) Same as "a," except soft stone.

(d) Medium stone base, hard stone top.

(e) Specially treated soft stone.

Sweden to Develop Road System

Adops American Methods to Construction of Highways

A new epoch in Swedish road maintenance and road-building methods, with American participation, was started at the recent annual meeting of the Swedish Good Roads Association.

It was announced that many townships have decided to abandon the old-fashioned method of letting the farmers maintain the roads, chiefly by hand labor. This work will now be leased to contractors using up-to-date machinery along the same lines as in the United States. A careful study of American methods has been made, and Paul Wretlind, an engineer of the association, who has just returned from America, reported on the efficiency of road improvement work there, mentioning especially the work of the Office of Public Roads and the National Research Council. It is believed that the new era in Swedish road construction will mean a considerably increased demand for American road-building machinery.

The Swedish Riksdag has appropriated more than 4,000,000 kronor for the building of new roads and for improvement of old ones. Part of the recently imposed automobile tax will be applied to the same use.

New York State to Spend $13,500,000 for Highways

Gov. Smith Signs Five Acts Providing for State Roads

Appropriations aggregating nearly $13,500,000 for highway construction, maintenance and repair became effective March 31, when Governor Smith signed five appropriation measures. One carried an appropriation of nearly $5,000,000 for construction of rural post roads, but, as this was the Federal Government's share of the undertaking, the amount will be refunded to the State later.

Motor Vehicle Conference Committee Renders Report On Highway Taxation

Advocate General Taxation for Highway Construction and Special Taxes on Motor Vehicles for Road Maintenance

Limitation of taxation on automobiles to the amounts necessary for the maintenance of improved highways and the administration of state motor vehicle departments with the state as the sole taxing agency is advocated in the report of the Motor Vehicle Conference Committee on which is represented the American Automobile Association, the Motor and Accessory Manufacturers' Association, the National Automobile Chamber of Commerce, the National Automobile Dealers' Association and the Rubber Association of America. Representatives of these five great national organizations after a careful study of the taxing situation in all parts of the United States declare that federal, state and municipal law makers and governing bodies are turning to motor vehicle manufacture, sale and use as fertile fields for raising a big share of the annual revenues needed to finance governmental activities and in doing this are placing special taxes on the automobile, which are rarely based upon sound theories of economics or equity.

The committee contends that no money derived from the special taxation of the motor vehicle should be spent for maintenance of highways unless such highways are located where the highway transportation needs of the state require and unless such highways are built of materials and in a manner to meet these needs. It is pointed out that every tax assessed against an automobile, with the exception of the personal property tax, is a special tax and the automobile is subjected to a greater percentage of these kind of taxes than any other one class of property.

Development of good roads and then maintenance during the days of the animal drawn vehicle were financed through the expenditure of money taken out of the general purse, the law makers holding that the whole people benefited by the expenditure of money for such purposes. With the advent of the automobile this view gradually changed until today every legislator with a pet road building scheme for his own community plans to foist additional taxes on automobiles throughout the state in order to raise the necessary money. Many legislators hold to a new theory, namely, that motor vehicle transportation should pay every penny of the highway's burden annually.

The Conference Committee regards such a theory as unwise economically and entirely unfair and unjustly hampering to the logical and legitimate growth to which the motor vehicle is entitled. It believes that the best interests of all concerned will be best served by general taxation of motor vehicles for highway maintenance.

'Every tax that is levied against the automobile eventually comes out of the pocket of the consumer," said M. O. Eldridge, Executive Chairman of the American Automobile Association. "The widespread use of the automobile has placed small cars in the hands of thousands who can ill afford to pay an additional tax and who should not be required to pay special taxes while vast properties owned by men of wealth, which automatically increases in value through the building of these same good roads, are not required to pay any special taxes.

"For instance, suburban real estate developments have flourished near all cities as a direct result of the increased growth of the automobile and property which could readily be bought for $500 an acre a few years back is now selling for $10,000 and $12,000 an acre through subdivisions into lots. The good roads which many legislators presume to charge to the automobile have aided in increasing the value of that property."

The Motor Vehicle Conference Committee, in discussing gasoline taxes, declares that gasoline consumption is a fairly accurate and practic-

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Indiana Has $29,811,000 Road Program

Plans 959 Miles of Hard-surface Highways—154 Miles To Be Built During Present Year

Nine hundred and fifty-nine miles of hard-surface road, the estimated cost of which is $29,811,000, will be constructed in Indiana during the next three years under a program just announced by the state highway commission. This year 153.9 miles will be built in 1924, and 399.5 miles in 1925. The roads will all be federal-aid projects, the federal government paying half of the cost.

Roads to be paved this year are: Michigan City, east (Boot Jack road) 13.6 miles; South Bend, south, 10.5 miles: Ft. Wayne, west (Liincoln Highway), 12.6; Evansville, north 8.6; Evansville, east, 6.4; Haysville-Crystal, 8.8; Indianapolis-Lebanon, 1.5; Carmel-Kokomo, 12.1; Carmel-Kokomo, 11.7; Ft. Wayne, east (Lincoln Highway), 12.6; Angola, west, 9.8; Seymour-Scottsburg, 16.4; Terre Haute-Farmersburg, 12; Lebanon-Indianapolis, 2.3; Reelsville, 1.5; Terre Haute-West Terre Haute. 2.5.

Roads to be paved in 1924 are: Lagrange-Middleburg, 26.5 miles; Indianapolis-Auburn, 20; Anderson-Alexandria, 3.5; Anderson-Muncie, 16; Ft. Wayne-Plymouth, 60; Indianapolis-Shelbyville, 18; Indianapolis south (Bluff road), 25; Indianapolis-Lafayette, 45; Veedersburg-Lyford, 30; Kokomo-Peru, 15; Boswell-Chicago, 80; Scottsburg, south 25; French Lick-Crystal, 6.5; Hazelton, south, 15; Sullivan, north, 10; Dale-Friendship, 10.

Roads to be paved in 1925 are: Sullivan-Hazleton, 45; Peru-Plymouth, 40; Terre Haute-Lyford, 15; Veedersburg-Boswell, 34; Lafayette-Fowler, and west, 30; Valparaiso-Plymouth, 40; Franklin-Columbus, 20; Angola, east, 10; Middleburg, west, 10; Anderson-Marion, 125; Ligonier-Churubusco, 15; Martinsville-Bloomington, 12; Muncie-Portland, 30; Connersville, Cambridge City, 12; Jasper-Haysville, 10; Ft. Wayne-Alexandria, 52; Lagrange, east, 12.

able measure of highway use and that a tax upon this fuel constitutes a fair method of taxation provided it is not imposed as a super-tax on all the other taxes that the motorist is now required to pay. It is pointed out that its extension should be opposed unless the annual proceeds as a single tax or in conjunction with other taxes are made to conform to the amount which properly and equitably should be levied upon the motor vehicle.

The main consideration, the committee report concludes, is that irrespective of the particular form of special taxation any state may adopt, the all important thing is that the aggregate amount of these special taxes upon motor vehicles in any one year shall not be more than is necessary to maintain the improved highways of the state.

New Indiana-Illinois Road Is Planned

Midland Trail To Be Important State Outlet—Mammoth Bridge To Be Built at Vincennes

The Midland Trail, a highway from Vincennes across Illinois to St. Louis, is one of the most important Indiana outlet roads that is being advocated as a connecting link between the two states, and efforts are being made to have 10 miles of it, from Lawrenceville to Vincennes paved this year. The 10 mile stretch is all in Illinois territory and is to be constructed by the highway commission of that state, although work on it may not be started until next year.

To connect with Vincennes, a large bridge will have to be thrown across the Wabash rive, and the Indiana and Illinois highway commissions with Federal aid, are expected to finance this project.

Another bridge will span the Embarrass river at the edge of Lawrenceville, and engineers of the Illinois commission now are going over the road and making calculations for the structure.

The highway now between Vincennes and Lawrenceville is of gravel. Motor traffice over it is in such large volume that it is with difficulty kept in condition for use. When the Midland Trail is completed from Vincennes to St. Louis, it will be the most important market outlet for southern Illinois east and west. It will also tap the Wabash valley with its riches of agriculture, coal and oil.

U. S. Good Roads Association Annual Meeting Opens in Greenville, S. C., on April 16, 1923

United States senators representatives, governors, highway commissioners and technical experts from various parts of the country will gather in Greenville, S. C. on April 16 for the annual conventions of the United States Good Roads association and the Bankhead National Highway association to be held at Textile Hall April 16-21.

The annual convention of the United States Good Roads association will open on Monday, April 16, and last through the forenoon of Thursday, April 19. The Bankhead convention will be held during the remainder of the week, adjourning Saturday at noon.

The United States Good Roads show, will occupy most of the lower floor of Textile Hall, will last throughout the week.

Following is a partial program:

Address of welcome on behalf of Greenville, Mayor H. C. Harvley.

Address of welcome on behalf ot South Carolina, Governor Thomas G. McLeod.

Address of welcome on behalf of Greenville Congressional District Congressman J. J. McSwain.

Address of welcome on behalf of Greenville Chamber of Commerce, Col. H. B. Springs, president.

Address of welcome on behalf South Carolina State Bankhead National Highway association, J. C. Duckworth, vice president.

Response, Governor W. W. Brandon, of Alabama, and vice president at large of the United States Good Roads association.

Response, Bennehan Cameron, North Carolina, president Bankhead National Highway association.

Response, Mrs. Albert E. Thornton, president Womens' Commission Bankhead National Highway association.

Tuesday

Annual address by Governor O. A. Larrazola, president of the United States Good Roads association.

Address by U. S. Senator Charles E. Townsend, of Michigan, chairman of committee on post office and post roads.

Address by C. M. Upham, state highway engineer, North Carolina, "Construction of Highways With Sub-Grade."

Address by Governor Lee Trinkle, Virginia.

Address by Gutzon Borglum, Stamford, Conn., "Stone Mountain on the Bankhead Highway the Mecca for Tourists."

Wednesday

Address by Governor Thomas G. McLeod, South Carolina.

Address by Governor W. W. Brandon, Alabama.

Address by U. S. Senator E. D. Smith, South Carolina.

Address by Dr. W. M. Riggs, Clemson College.

Address by Dr. Miller Reece Hutchinson, New York.

Address by B. Harris, commissioner of agriculture, South Carolina.

Address by John N. Holder, chairman state highway commission of Georgia.

Address by Hubert Scruggs, state highway commissioner, Alabama.

Thursday

Practical road building, maintenance, finance, etc. Discussion opened by A. B. Langley, state highway commissioner, South Carolina; followed by W. R. Neal, state highway engineer, of Georgia; W. F. Wittemore, state highway commissioner, of New Jersey; C. H. Moorfield, state highway engineer of South Carolina.

Address by George A. Nelson, Alabama, one of the founders of the United States Good Roads association, "Good Roads the Height of Civilization."

Address by Governor T. W. Hardwick, Georgia.

Addresses by Judge E. P. Toney, of Arkansas, and Judge H. L. Small, of Texas, "Road Building in the West."

Address by W. S. Linton, Michigan, "Trees on the Highway."

Wisconsin to Spend $3,000,000 for Highways

Recent Legislation Makes Sum Available

A bill passed by the Wisconsin Assembly makes immediately available the sum of $1,500,000 to meet federal aid in the same amount, thus placing in the highway construction fund the sum of $3,000,000. This bill provides merely for preliminary and immediate financing.

The bill, No. 124, S., passed the Senate unanimously and but two votes were cast against it in the Assembly. There is a surplus of $711,000 of automobile license fees left over from last year which under the law governing maintenance could not be spent for maintenance purposes. Bill No. 124, S., permits this fund to be used to meet federal aid and empowers the taking of $789,000 from this year's license fund for the same purpose, thus making immediately available $1,500,000 to meet an equal amount of federal aid.

The joint highway committee has practically decided upon the major highway bill providing for highway financing for the years 1924-1925. The bill proposes to raise $8,000,000 of funds for state road construction and maintenance by a license tax on motor vehicles based on weight, beginning at $10 with the Ford car and graduating upward. In addition to that it provides for raising $3,000,000 by a gasoline tax of two cents a gallon, this $3,000,000 to be distributed among the counties on the basis of rural highway mileage of the counties to be spent on such roads as the county boards determine. This would make a total available through state action of $11,000,000.

The bill providing for the election of county highway commissioners directly by the people instead of by the county boards was beaten in the Assembly by a vote of 58 to 31.

National Motorists Association To Promote "Save the Roads" Campaign

Highway conservation should be considered with highway promotional efforts throughout the country particularly at this time of the year, according to Good Roads Board of the National Motorists Association. Hundreds of thousands of dollars are annually lost in practically all sections of the country due to lack of regulatory measures in the spring of the year when the frost is coming out of the ground during which period also there is a greater percentage of rain. Some states have taken the precaution of mandatory laws requiring lesser loads on trucks on the improved roads of the state or inter-county highway system. This has proved a considerable saving in the expenditure of maintenance monies. As pointed out by the National Motorists Association officials an overloaded truck in the spring of the year can cause a hundred-fold more damage to a highway than the passenger or pleasure motor vehicle.

"It is about time that the money spenders of state legislatures thought more about conservation of highways already built than of adding additional tax burdens in the form of special taxes against the use and ownership of the passenger vehicles or the family flivver," states Fred H. Caley, Secretary of the National Motorists Association at Washington. "We are not in any sense opposed to the proper operation of the motor truck or bus line but we do believe that officials having jurisdiction over highways that cost thousands of dollars should carefully watch the road bed at this time of year and curtail the loads allowed on those highways when evidence is shown that the road is being destroyed or seriously damaged by heavy unit vehicles.

Senator Jones Makes Cross Continent Tour to Home State

Senator W. L. Jones of Washington, Chairman of the Commerce Committee and a member of the Senate appropriation committee also lately of Ship Subsidy fame, is to make a trans-continental tour to his home state which will follow the old National Pike to St. Louis, the old Santa Fe Trail from there to California and the Pacific Highway north into Washington. Although this is not the time of year when long tours are in vogue, the Senator insisted on making the drive, and chose the route outlined by the National Motorists Association, who took special pains to see that the Senator had the latest road information, and telegraphic reports were received which were so encouraging that the Senator promised Director Lasker of the Shipping Board that he would certainly attend a conference in San Francisco on May 15th.

Engineering Employment Continues Favorable

Demand for Highway Engineers Exceeds Supply

Engineering services continue in demand with practically no unemployment in the ranks of professional engineers is reported by the employment department of the American Association of Engineers. Construction work has not fully opened up but is continuing at a regular winter diminished rate with the best prospects of a wholesome activity this year. The general mood of the public on business conditions is very cheerful and there is no apparent loss of confidence. Recent advances in the cost of materials, particularly the increase in the cost of steel, may result in a number of projects being held up. Several big projects in the central west which would run into a cost of several millions, have already been held up on this account.

There is a possibility that shortages will exist for both skilled and unskilled labor which is already becoming noticeable in industrial establishments. If the European political and financial situations are ironed out soon, this country will probably experience a most excellent era of prosperity when coupled with the present favorable general conditions. The state Highway programs for the entire country will aggregate this year, an expenditure close to three quarters of a billion dollars. Very few highway engineers of experience are available for employment and it will be necessary for the highway commissions to engage inexperienced men for their staff or obtain young men who are graduating from universities this year.

The present great demand continues for designing engineers, including structural, mechanical and architectural. This holds true for practically all sections of the contry except some sections in the East. Boston reports that little engineering activity is in progress in the northeastern section. Most of the engineers are employed but very little outside activity is evident. New York reports considerable designing work now being undertaken with excellent prospect for construction work starting soon after the first of April. Practically all other sections of the country report a shortage of professional engineers except a few sections west of the Mississippi River where the supply and demand about balance.

Minnesota Legislation Acts on Highway Bills

By a vote of 39 to 23, the State Senate of Minnesota has passed a bill to allow counties which have not already done so to issue up to $250,000 each of bonds for improvement of trunk routes, reimbursement to be made from motor vehicle tax receipts by the state. Official estimates were that not more than $4,000,000 of bonds will be issued under this authorization and that they easily can be paid with interest from auto taxes at the given rate. Reinactment of this law was favored by Charles M. Babcock, state highway commissioner, that all counties may share more equally the benefits of improvements under the new highway program.

Survey of Indiana Roads Now Under Way

Patrolmen Make Reports to Highway Commission—Weak Spots Will Be Repaired During Summer

In order that all weak spots in stone and gravel roads in Indiana system may be surfaced with additional applications of material, and to determine where additional drainage is needed, patrolmen of the state highways have been instructed by John D. Williams, director of the state commission, to make state superintendent of maintenance. careful notations and reports to the

"We are checking up on all breaks in the roads this season so that they can be repaired this spring and summer and placed in condition to go through next winter in as near perfect shape as it is possible to make non-rigid type roads under heavy traffic tests," said Mr. Williams.

According to A. H. Hinkle, superintendent of maintenance, it is extremely important that patrolmen make a careful record of all places where repairs are needed, as this is an indication of a weak subgrade and before next spring a heavy coating of stone or gravel should be placed in such places. "To barely repair in order to get by this spring and neglect the weak spots until next spring is not proper management of your work," the patrolmen were told. The instructions to patrolmen also say: "At this particular season of the year observation will show in a new place and water standing on the road surface and in the ditches. The shoulders should be cut through to permit the water from the edges of the material to get to the side ditch. Open up the main ditches necessary to provide proper drainage. If a road has not given away in its foundation but "sloped" up during the spring thaw to considerable depth, it is an indication that the grade of metal on the road is not of high quality and a certain amount of stone or gravel should be added to help reduce the percentage of clay or silt in the material already on the road."

Mr. Hinkle said state roads are coming through the spring 100 per cent better than last year. Stopping of heavy truck traffic in the most severe periods helped materially and proper drainage was the other chief contributing factor.

HIGHWAY CONTRACT NEWS

● ILLINOIS

Bids will be received by the Department of Public Works and Building, Division of Highways, Springfield, Illinois, until April 13, 1923, for the road work on Fed. Aid Project, Sec. 12, Union County, width feet 18, 19 and 20, approximate length miles 4.805.

Bids will be received by the Dept. of Public Works and Bldgs., Division of Highways, Springfield, Ill., until April 13, 1923, for Federal Aid Bridge work, designated by county, section and project below:

Concrete bridge at station 1976/20, Federal Aid Project No. 68, Will County. designated as Section 19B. Spans 2 at 60 ft.; roadway 30 ft. and two five-foot sidewalks, height overall 24 ft. Total estimated quantities: Class A concrete 642.7 cu. yds.; .Class B concrete 116.2 cu. yds.; reinforced steel 122,730 lbs.; structural steel expansion guard 730 lbs.; brick masonry 10.6 cu. yds.

West Station Street Bridge: Project 69, Section 21, Kankakee County, Route 17. Reinforced concrete open spandrel arch: Spans 5 at 70 ft.; roadway 33 ft. with two 5½ ft. sidewalks; height overall varying from 31 ft. 4 in. to 42 ft. 4 in. Total estimated quantities: Class A concrete 1484.7 cu. yds., Class B 2887.5 cu yds., Class A curbs 2.7 cu. yds., Class B retaining wall 26.8 cu. yds.; 10 ft. Class A pavement 150 sq. yds.; 5 in. Class A sidewalks 54 sq. yds.; reinforcing steel 200,740 lbs.; rubble masonry wall 30 cu. yds.; brick rail 34.7 cu. yds.; 4 in. brick pavement on ¾ in. tar cushion 1,353.6 sq. yds.; 8 in. cast iron pipe 64 lin. ft.; four cast iron gutter boxes; one lighting system complete; one name plate.

Concrete bridge at Station 424/20, Federal Aid Project No. 61, Ford County. designated as Section 32B. Spans 3 at 30 ft.; roadway 22 ft.; height overall 22½ ft. Total estimated quantities Class A concrete 317.9 cu. yds.; Class B concrete 138.6 cu. yds.; reinforcing steel 47,610 lbs.; brick masonry 8.3 cu. yds.; structural steel expansion guard 1,090 lbs., and one name plate. Cement for this work will be furnished by the State.

Concrete bridges with stone arch facing at Stations 46-50, 83-48, and 102-91.9 on Route 42, Cook County, designated as Section 112. Spans 50 ft., three at 40 ft. and three at 60 ft. Roadways 30 ft., and two sidewalks at 5 ft. each. Height overall 29 ft. 19 in. to 37 ft., and 24 to 52 ft. Total estimated quantities Class A concrete 2,922.3 cubic yds.; reinforcing steel 380,750 lbs.; structural steel 3,080 lbs.; stone masonry 771.2 cu. yds.; three name plates; 1,050 ft. of 1 in. pipe conduit; 16 switch and pull boxes and 150 ft. of 6 in. field tile.

Steel bridge at Station 196/80 and concrete bridge at Station 299/39, Project 55, Bureau County. Steel superstructure at Station 196/80, designated as Section 13C. Remainder of work designated as Section 13B. Spans 80 ft. and three of 40 ft.; roadways 22 ft.; height overall 20 and 15½ ft. Total estimated quantities: Section 13B, Class A concrete 415.9 cu. yds.; Class B concrete 75.8 cu. yds.; reinforcing steel 63,440 lbs.; structural steel 1,090 lbs.; one name plate. Section 13C, Class X concrete 36.9 cu. yds.; reinforcing steel 3,540 lbs.; structural steel 64,660 lbs.; one name plate.

Concrete bridge at Station 266/76, Federal Aid Project No. 69, Kankakee County, designated as Section 1B. Spans 5 at 55 ft.; roadway 20 ft. and one 4 ft. sidewalk, height overall 25 ft. Total estimated quantities, Class A concrete 753.0 cu. yds.; Class B concrete 346.1 cu. yds.; reinforcing steel 160,820 lbs. Structural steel expansion guards 2,660 lbs.; brick masonry 26.4 cu. yds.; one name plate; 48 lineal feet of guard fence; 58.4 square yds. of Portland cement concrete approach pavement; 580 square yds. of Portland cement concrete pavement on bridge, and 5.4 cu. yds. of macadam shoulders. This contract includes the construction of a temporary bridge.

Concrete bridge at Section 993/40, Federal Aid Project No. 26, Sangamon County, designated as Section 26B. Span 40 ft.; roadway 22 ft.; height overall 26½ ft. Total estimated quantities: Class A concrete 340.8 cu. yds.; reinforcing steel 43,660 lbs.; one name plate.

Gaylord bridge—Span 16 ft.; roadway 16 ft.; height overall 9 ft. Total esti-

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National Conference on State Parks to Be Held in May

Good Roods to Be Feature of Sessions

Conservation of the nation's vast natural resources through a nationwide system of State parks, similar to those now provided by the Federal government and a few of the more progressive States, is expected to receive a very decided impetus as a result of the Third National Conference on State Parks, to be held early in May. Friends of conservation from every section of the country, representatives of park boards, and official delegates named by the governors of practically every State in the Union will gather in picturesque Turkey Run State Park, Indiana, on May 7th, for a three-day convention.

Judge John Barton Payne, of Chicago and Washington, former Secretary of the Interior, and President for twelve years of the South Park Commissioners of Chicago, is serving his second term as Chairman of the National Conference on State Parks. He believes the establishment of new State parks will not only serve to strengthen the National policy of conservation, but will prove a boon to thousands of motorists.

"Each year the number of touring motoroists has been increasing by thousands," Judge Payne explains. "With the steady increase in good State and National highways, and the increased number of automobiles sold, motor touring has become more and more popular. But most people, when starting out, want some objective. This can be murnished with more State parks. The ninteen National parks have proved an attraction to literally hundreds of thousands, but they are entirely inadequate to care for all the tourists."

The meeting at Turkey Run State Park next month will be the third of its kind since this organization was formed at Des Moines, Iowa, in 1921 by a group of public spirited citizens interested in developing the idea of State parks. The initial gathering called by Judge Payne while he was Secretary of the Interior was largely of a missionary character. The second convention, held last May at Palisades Inter-State Park, Bear Mountain, N. Y., was successful in interesting a number of States in starting State park projects, notably in Utah, Missouri, and Nebraska. It is believed that the forthcoming conference will prove even more successful.

Judging by letters of acceptance received from governors, more and more States are ready to launch their own park projects. Delegates are being sent to Turkey Run with definite instructions to obtain the advice and practical suggestions of representatives from States which have their own park systems.

It is expected that growing out of the Turkey Run convention there will be formed a more stable organization for all-year-round work in behalf of State parks. At present the National Conference is limited to an annual meeting. The contemplated plan is for an organization which can act as a clearing house for information on State parks, and which can be utilized by various States in fostering park plans.

Turkey Run State Park, which is a short motor run from Indianapolis, was chosen for this year's Conference after invitations had been received from four other cities, St. Louis, Cleveland, Chicago and Baltimore. It was created as Indiana's State Park as a centennial monument in 1916, and is said to be one of the most beautiful State parks in the country. Special arrangements for housing the delegates, providing transportation and suitable entertaiment, have been made by the Indiana State Department of Conservation.

The program will include addresses by Stephen T. Mather, Director of National Parks Service in the Department of the Interior since 1917, who was one of the most active in establishing the National Confeence; Professor Frank A. Waugh, of the U. S. Foret Service; Surgeon General Hugh S. Cumming, of the U. S. Public Health Service; Commissioner of Dominion Parks J. B. Harkin, of Canada, and by a representative of New York State who will discuss New York's proposed $15,000,000 bond issue the proceeds of which are to be devoted entirely to State parks. The conference will be formally welcomed by Governor Warren T. McCray, of Indiana, and on the second day there will be an inspection trip through the 479 acres of Turkey Run under the guidance of Director Richard Lieber.

The Conference Committee is composed of Judge John Barton Payne, Chicago and Washington, Chairman; Chauncey J. Hamlin, Buffalo, Vice Chairman; Beatrice M. Ward, Wash-

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ington, Secretary; Alfred M. Collins, Philadelphia, Treasurer; Dr. Henry S. Cowles Chicago; Joseph D. Grant, San Francisco; Edgar R. Harlan, Des Moines; Franklin W. Hopkins, New York; J. Horace McFarland, Harrisburgh; Charles G. Sauers, Indianapolis, and Mrs. Samuel Sloan, New York.

Colorado To Erect Standard Road Signs

By the end of the summer the principal highways of Colorado will be sign-posted and tourists will not have to stop and ask the way at every turn in the road. The Rocky Mountain Motorists, Inc., have arranged as one of their major activities, the sign-posting of all the roads in the state and within the next sixty days the markers will begin to go up at various points throughout the state.

The sign-posting of the roads will be on a comprehensive scale and will eventually cover every state highway and county road in the state of Colorado, and later will reach out into the surrounding territory on all the well-traveled main highways.

Under the arrangements made by the Highway Department under Major L. D. Blauvelt, The Rocky Mountain Motorists, Inc., will supply the road markers and the pasts. The Highway Department will then place and erect them in concrete bases.

The road-markers will be of vitrolite-enamel on steel. The posts will be 2½ in. boiler pipe.

Indiana to Open Bids for 22 Bridges on May 1

Proposals will be received by the Indiana State Highway Commission May 1 for construction of 22 bridges in fourteen counties, for paving approximately 10 miles of roads, and grading and structures under 20 ft. on 2 1-3 miles. When these paving awards are made it will practically place all of the 1923 had surfacing program under contract.

According to William J. Titus, chief bridge engineer for the commission, the bridge program at this letting calls for an approximate expenditure of $250,000, of which $200,000 is federal aid. The largest structure is across Eel river on State road 9, in Clay county. It willl be 450 ft. long and will cost about $75,000. The bridge is paid for by Clay county, the commissioners of that county turning the money over to the state highway commission which, under the state aid plan, prepares plans and specifications and builds it. The other bridges considered at this letting are: Two in Warrick county; 1 Vanderburgs; 1 Spencer; 1 Clay; 1 Lake; 4 Warren; 1 Jackson; I Orange; 2 Davies; 1 Jasper; 1 Sullivan; 2 Starke; 1 Randolph; 3 Floyd.

The paving projects are as follows: Lagrange-Angola road, from 5 miles west of Angola to Angola, Steuben county, 4,681 miles. Dixie Bee Line from Youngstown to Terre Haute, Vigo county, 4.9 miles. The commission is also asking bids for grading and structures under 20 ft., and gravel base course on 2.330 miles on the Gentryville-St. Meinrad road from Gentryville to Lincoln City, in Spencer county.

Motor Vehicle Registration Gains

In 1922 motor vehicle registrations more than maintained the rate of rapid increase which has caused the total registration to grow from 3,500,000 in 1916 to 12,238,375 motor cars and trucks at the end of 1922, according to the U. S. Bureau of Public Roads. Last year the increase amounted to 1,775,080 registrations as compared with an average yearly rate of approximately 1,390,000 for the preceding 5 years.

The total gross registration revenue amounted $152,047,823, of which $117,093,116 was applied to road work under the supervision of the state highway departments. Eighteen states taxed gasoline, deriving a revenue of $11,923,442, not all of the states reporting for a full twelve month period.

National Highway Traffic Association To Hold Anual Meeting May 10

The 1923 Annual Meeting of the National Highway Traffic Association will be held in the Assembly Hall of the Automobile Club of America, 247 West 54th Street, New York City, on May 10th. The program will include the presentation and discussion of the following reports of National Committees:

Afternoon Session, 2:00 P. M.

"Traffic Center Lines on Roadways," Chairman, Frank T. Sheets, Illinois State Superintendent of Highways.

"Status of the Construction of Highway Curves and Recommended Practice to Increase Safety to Traffic," Chairman, H. Eltinge Breed, Consulting Highway Engineer, New York City.

"Highway Danger Signs," Chairman, G. C. Dillman, Deputy State Hihway Commissioner of Michigan.

"Mechanical Devices for Highway Traffi Regulation," Chairman, Professor Louis W. McIntyre, University of Pittsburg.

"Regulations Covering Speeds, Weights and Dimensions of Motor Trucks and Trailers," Chairman, George H. Pride, President, Heavy Haulage Company of New York City.

"Regulation of Overloading of Motor Trucks," Chairman, David C. Fenner, Manager, Public Works Department, International Motor Company, New York City.

"Rural Motor Express," Chairman, J. H. Collins, Manager, Research Department The Chilton Company, Philadelphia.

"Highway Transport Clearing House," Chairman, Tom Snyder, Secretary, National Association of Commercial Haulers Indianapolis.

Dinner 6:00 P. M.

An informal dinner, at $1.50 per cover, will be served in the Grill Room of the Automobile Club of America. Reservations should be sent to Elmer Thompson, Secretary, National Highway Traffic Association, 247 West 54th Street, New York City.

Evening Session 8:00 P. M.

"Safety Regulations at Railroad Grade Crossings," Chairman, H. A. Rowe, Claims Attorney, Delaware, Lackawanna and Western Railroad Company.

"Equitable Distribution of Cost of Construction, Interest on Bonds, Replacements, and Maintenance of State Highways," Chairman, William H. Connell, Assistant State Highway Commissioner of Pennsylvania.

"Highway Transport Franchises," Chairman, Harry Meixell, Secretary, Motor Vehicle Conference Committee, New York City.

"The Demand for National Transportation and the Function of Streets and Highways," J. Rowland Bibbins, Chairman, National Committee on "Development of Transportation," and Consulting Transportation Engineer, Washington, D. C.

Indiana to Start Work on 1923 Program

By its construction of S. B. 249 the Indiana State Highway Commission will proceed at once to construct State Road 1 (Range Line), through the incorporated towns of Westfield, Carmel, Lakeville and Lapez. S. B. 249, enacted by the last General Assembly, empowers the highway commission to pave and maintain state roads in the corporate limits of incorporated towns of 2500 inhabitants or less. The commission's construction of this law is that approximately 383 towns on Indiana state roads will be affected. The four towns referred to will be given immediate aid as they are on state roads to be improved in the commission's 1923 construction program. According to Mr. Williams the commission will soon select other towns to thus benefit, selection being governed where state roads adjacent to the corporate limits of towns in this class are now under construction.

Where the highway commission pays the cost of paving through a town, pavement will be constructed 19 ft. wide—standard width—but the commission will encourage a wider pavement, with the towns thus benefiting paying the cost of additional pavement.

Under H. B. 481 counties wishing to contribute funds to the commission to assist paving certain roads in their territory may do so. This bill was originally drafted in behalf of Lake county in order that that county could help pay for building the "Ideal Section" of the Lincoln Highway. The Ideal Section is about a mile and half long, a show pavement and the finest ever constructed. The pavement is 40 ft. wide on a 100 ft. right-of-way and adjacent territory will be landscaped and the whole pavement illuminated with electric lights. The pavement is much thicker than ordinarily laid and is reinforced with steel. Under the engrossed act Lake county pays $25,000 toward construction, the highway commission for the cost of an 18-ft. pavement, and the remainder is paid by the Lincoln Highway Association. Several counties have, since passage of this bill, notified highway officials they are preparing to improve roads under this act.

Mr. Williams says it is the policy of the commission to pave some state roads in a limited number of towns not affected by S. B. 249, but benefited under House engrossed act 481. This will be done by estimating cost of maintenance for five years and using such sum on cost of pavement, with the condition towns thus benefited contribute the additional cost of construction.

"Safety First" Campaign for Highway Builders Urged

Thirty per cent. of injuries to employees of the state highway department over a period of 3 years was due to improperly cranking auto trucks, the motors back-firing and accidents occurring, according to a compilation just completed by Leroy Wertz, chief clerk, and A. H. Hinkle, superintendent of maintenance of the Indiana State Highway Commission.

With a view of minimizing these accidents, largely due to carelessness and lack of knowledge of how to crank a motor, Mr. Hinkle recently sent a bulletin to district superintendents, urging they call a meeting of their patrolmen and men handling trucks, and properly instruct those who are not familiar with such work. During the course of a year there are many changes in the personnel of the maintenance division which, in rush seasons, often employs 5,000 men, and many of them, new in the work, must be broken in, Mr. Hinkle says. The bulletin in part says:

"In looking over accident claims filed against the commission due to our workmen having been injured while in the performance of their duty, we find that 30 per cent. of said claims are the result of injuries to the men while cranking trucks. It is also noticeable that many of these men are new in the work.

"Owing to the large number of accidents from this cause, it is extremely desirable that superintendents emphasize upon all patrolmen and truck drivers the importance of knowing how to crank a motor so as to avoid an accident. They should not only know how, but should practice the safe method in doing this work. If you are not certain as to the best way, your mechanics will instruct you.

"Other causes of injury are so miscellaneous that it is impossible to

Wisconsin to Tax Gasoline for Highway Maintenance

Eighteen States Now Have Similar Tax

Wisconsin will collect a one cent road revenue from every gallon of gasoline used in motor mehicles on the highways. Road officials interested in the matter of raising money for roads by tax on the gasoline consumed by motor vehicles will be interested in the following Wisconsin figures. During the fiscal year there was tested in the state 2,518,459 barrels of gasoline. This is approximately one barrel for every man, woman and child in the state, the population being 2,631,839. There are fifty gallons of gasoline in a barrel, making a total of 125,922,950 gallons used in the state. Using 4,000 miles as the average for the miles for all cars per year, and 12 secured miles per gallon as the average miles secured, Wisconsin's 325,000 licensed cars would probably use 108,330,000, which at the rate of 1c per gallon would net the state $1,083,333.

Of the eleven states whose legislatures convened last year, four enacted a gasoline tax. They are Maryland, Louisiana, South Carolina and Mississippi. Bills for a gasoline tax are still pending in Massachusetts and Rhode Island. In all of these cases, as has hitherto been the custom, the gasoline tax has been enacted in addition to the customary motor vehicle registry and general license fees. The gasoline tax in these four states is 1c a gallon.

These recent additions give a total of 18 states in the Union which collect fees on gasoline purchased within their borders. The 14 which previously had the law are Arizona, Arkansas, Colorado, Connecticut, Florida, Georgia, Kentucky, Montana, New Mexico, North Carolina, Oregon, Pennsylvania, South Dakota and Washington. The rate in every case is 1c a gallon, except in Oregon, where the fee is 2c. A gasoline fee bill was introduced into the recent New York legislature, but in view of the fact that registry fees were materially increased on both passenger cars and trucks no serious effort was made to pass it.

give special instructions for avoiding accidents. We note, however, that several injuries have resulted from our workmen. Also workmen frequently are struck by passing motorists. There are a few cases where an employee cranked a motor, the clutch was not in neutral and he was run down by his own machine. Naturally this sort of accident is due solely to carelessness.

The highway department during the rush season has approximately 1,000 motor trucks in operation in various parts of the state. These are supplemented by tractors, etc., according to John D. Williams, who points out that it is the desire of the commission to operate this motor equipment with a minimum number of accidents.

California May Cancel Road Contract

In accordance with a policy of economy and retrenchment inaugurated by the New Governor of California, the Highway Commission proposed to cancel contracts on several jobs not considered by the newly appointed Highway Commission as necessary parts of the main trunk highway. Before any action was taken on this plan, however, legal advisers of the State pointed out objections. Question is raised, for example, as to the legality of taking funds voted for road building with which to pay contractors for losses on abruptly terminated contracts. Meantime work is progressing on the contracts in question.

Travel on Lincoln Highway Will Break All Records This Year

The Lincoln Highway is the backbone—the main line—of an American highway transportation system, now gradually developing under the direction of the Federal Government. From it branch important highways leading to every section of the United States. The Lincoln Highway bisects the very heart of the Union, serving 60 per cent. of the population of the United States and being directly available to 67 per cent. of the registered automobiles. For ten years it has been called "The Main Street of the Nation." It is dedicated as a national memorial to President Lincoln.

The Lincoln Highway Association was incorporated in June, 1913, with the avowed purpose of "immediately promoting and procuring the establishment of a continuous, connected, improved highway from the Atlantic to the Pacific, open to lawful traffic of all descriptions, without toll charges and to be of concrete where practicable." Thus the Lincoln Highway as the first, nationally important, through route, was undertaken as "an object-lesson road." It was a start toward a national highway system.

The route was carefully and painstakingly laid out between New York and San Francisco to be the shortest and most direct consistent with the topography of the country. Its length is 3,305 miles from Times Square, Manhattan, to the Golden Gate in San Francisco.

The work of the Lincoln Highway Association has been successful beyond the most optimistic expectations of those who started it. But a line on the map ten years ago, today the Lincoln Highway is 90 per cent. a paved road from New York City to 45 miles west of the Mississippi River. By the end of this season there will be less than 60 miles of unpaved road out of the first 1,100 miles west of New York City. Work is rapidly progressing with Federal aid between the Mississippi River and the Pacific Coast and already after ten years of effort the completion of the route can be foreseen. It now carries a tremendous local, interstate and cross-country traffic.

The following table provides a picture of the amounts invested in the improvement of the Lincoln Highway, 1914 to 1922 inclusive, and shows the continuous progressive development of the route. In 1922, 235 miles of new construction were completed at a cost of over six million dollars. A greater mileage will be finished this year:

1914	$1,200,000
1915	2,580,280
1916	4,580,165
1917 (War)	2,500,918
1918 (War)	2,996,307
1919	9,386,800
1920	8,422,060
1921	9,472,906
1922	6,046,168
Total expended on the Lincoln Way in 9 yrs.	$47,185,604

In 1921 Congress passed the Federal Highway Act, providing a national system of important highways approximately 180,000 miles in extent, which will serve more than 75 per cent. of the total traffic of the Union. This system will now progress to completion within the next 15 years with the aid of Federal appropriations. Every state in the United States has now a highway department organized in accordance with the provisions of the Federal law and county and township units of highway construction are gradually merging with the more important and essential state systems which themselves link up to form a transportation system of national service.

During the past ten years, the Lincoln Highway Association, with headquarters in Detroit, Michigan, has brought the Lincoln Way near to completion through its educational efforts and expenditure of over $900,000, and has aided in bringing about the national recognition of the need for better highways which now exists. This year the route will be in the finest condition of its ten year history and will carry over 60,000 cars across the continent during the touring season between June 1st and Ostober 15th. The only real difficulty will be encountered in western Utah.

Dixie Highway To Be Improved

An appropriation sufficient to repair nine miles of the Dixie Highway embraced within the military reservation of Camp Knox, Kentucky, is in sight through the efforts of the Louisville Automobile Club and the National Motorists Association. Approval of the appropriation was secured by Eugene Stuart, Secretary of the Louisville Club, from the Commanding Officer of Camp Knox and the matter was brought to the attention of N. M. A. headquarters. Communication was at once established with the construction division of the Quartermaster Corps and an urgent request was made of the Commanding Officer Fifth Corps Area, Fort Hays, Columbus. Ohio, that the petition of the Louisville Club be approved. The Commanding General promptly recommended that $30,000 be set aside from the War Department Fund available for this purpose.

Federal Aid Not a New Idea

Federal aid for road building is not a new idea in the United States. Vol. III of the American Annual Register, 1827-1829, shows that a total of $4,177,549.06 was apportioned from the time of the adoption of the constitution to that date to assist individual states in works of public improvement, a large portion of which was for road building. The largest single item was for construction and maintenance on the famous old Cumberland road, a total of $1,622,245.75. Over $166,000 was set aside for the survey of roads and canals. The following is a partial list of the appropriations made:

Road from Cumberland to the Ohio	$1,662,245.75
Continuation of the Cumberland road	453,547.36
Repairs to the Cumberland road	55,510.00
Road from Nashville to Natchez	3,000.00
Road from Wheeling to the Mississippi River	10,000.00
Road from Missouri to New Mexico	30,000.00
Road from Mississippi to the state of Ohio	5,639.35
Road from Georgia to New Orleans	5,500.00
Road in Tennesseee, Louisiana & Georgia	15,000.00
Road from Nashville to New Orleans	7,920.00
Surveys of roads and canals	166,681.49
Surveys, maps & charts of the Ohio and Missippi rivers	4,168.24
Military roads	10,218.43
Survey of the water courses of the Mississippi River	11,122.04
Road through the Creek Nation	3,621.01
Opening the old Natchez road	5,000.00
Breakwater at mouth of Delaware Bay	5,000.00
Total	$4,179,549.06

Record Highway Construction in 1922

New records for highway construction throughout the United States were established during the last fiscal year according to the U. S. Bureau of Public Roads.

During the year 10,000 miles of federal aid highways and more than an equal mileage of roads, without federal aid, were constructed.

Federal highways completed, and those under construction, total 39,940 miles. During the year each state got at least 200 miles of new federal roads, while Texas headed the list with 933 miles of completed highway. Arkansas, Georgia, Minnesota, Iowa and North Carolina each got 400 additional miles of new roads.

Federal aid distributed to states under the new highway law totals $194,560,135, of which $166,911,552 has actually been paid out. Texas got the largest sum last year. Its allotment was $5,915,046. Ohio came next with $4,500,000. Iowa, Illinois, and Pennsylvania each received $4,000,000.

Weather conditions permitting and the shortage of freight cars somewhat relieved, officials predict that 1923 will witness even greater progress in the national system of highways, especially those roads that are definite connecting links.

When the mnufacture of powder was discontinued recently at the old powder works on the Brandywine of E. I. du Pont de Nemours & Company, motion picture views, showing several of the scenes, were taken. These views have been put into a one reel picture, which is available on request. This powder yard was the oldest of its kind in the United States, and was founded in 1802 by E. I. du Pont de Nemours; the scenes show the old type of buildings, together with the burning out of several of the mills.

The North Carolina State legislature has authorized an additional bond issue of $15,000,000 to be used by the state highway commission for the construction of roads and bridges. This, together with the $50,000,000 authorized by the 1921 legislature, makes available $65,000,000 for the construction of the state highway system. To this sum may be added the state's federal aid from the U. S. Bureau of Public Roads.

A feature of the new act provides a tax of 3 cents per gallon on gasoline and other motor vehicle fuels to take care of the interest on bonds, sinking fund, etc. The remainder, together with the proceeds of the motor vehicle licenses is to be used for maintenance purposes. This last sum will amount to around $5,500,000.

Massachusetts will hereafter put a tax on the highway sign even though erected on private property. The contention is that the value of the sign is derived from the public highway, not from private property on which it is located and that the first obligation is to the public who owns the highway and gives the sign an advertising value. Permission from the land owner is a secondary matter. It would be well for other legislatures to extend the Massachusetts idea and give the highway authorities some control over all signs erected on private property that in any way derive their value from their location as regards a public highway. This is the only way that the highway officials can keep any control over the sign and billboard nuisance along the public highways.

Canadian Good Roads Convention to Open June 11

Preparations are now under way for the tenth annual convention of the Canadian Good Roads Association to be held at the Royal Connaught Hotel, Hamilton, on June 11, 12, 13 and 14 next, and steps have already been taken that promise to make this gathering of all interested in highway matters one that will stand out above the successes of the past by reason of its practical utility.

The outstanding feature of the convention will be the attention paid to the economic factor in highway construction. In past years stress has rather been laid on the different methods of construction and the types of road that might be built. These facts are pretty well appreciated now and the thing that municipal bodies are chiefly interested in is expenditure. It is well known that the cost of construction of highways varies to an exceptional degree between different provinces, and even between municipalities in the same province A big effort is to be made at the Hamilton convention to get to the root of the question, by securing from every province data regarding the cost of materials, of workmanship, and other details. This will apply to maintenance as well as to construction, and the information that will be accumulated will provide a valuable guide to construction engineers and undoubtedly enable many to reduce the cost to the ratepayers of all branches of construction.

Another important phase of the convention will be the latest information on the many test road experiments that are being carried on in the United States with a view to ascertaining the types of road best suited to modern traffic conditions. The interests of the highway builders and highway users have to be brought together in order to secure the best results for the future, and so the program for this convention will provide for discussion as to the proper use of the highways and the prevention of abuses. The best methods of regulating traffic, both as regards passenger cars, autobusses and trucks, the making uniform of danger signals, direction signs, safety laws, headlights, speed. The question of lights on all vehicles, and other matters of a similar nature will all be discussed, for they have an intimate bearing on highway use and abuse. Federal aid and tourist traffic will also provide subjects for discussion, and generally speaking the program outlined by the executive indicates a big advance in the scope of the papers and discussions to be initiated at the decennial convention of the association. The Hon. J. L. Perron, Minister of Roads for the Province of Quebec, is the president of the Canadian Good Roads Association, while the secretarial duties are again being discharged by George A. McNamee, New Birks Building, Montreal.

HIGHWAY CONTRACT NEWS

ILLINOIS

Bids will be received until April 26, 1923, at the office of the Co. Supt. of Highways in El Paso, Illinois, for the construction of twenty concrete culverts and one concrete bridge to be built in Cruger, Olio and Montgomery Townships. Address Woodford, County; A. B. Hurd, Co. Supt. of Highways, El Paso, Illinois.

Bids will be received until April 21, 1923, at the County Clerk's office in Albion, Illinois, for the construction of one reinforced concrete bridge to be built in Road District No. 8, Edwards County. Address Frank D. Mayes, Co. Supt. of Highways, Albion, Illinois.

Bids will be received in the office of the Dept. of Public Works and Buildings, Div. or Highways, Springfield, Illinois until April 20, 1923, for Federal Aid Bridge Work at Stations 68-67 and 209-41. Federal Aid, Project No. 70, Richland County, designated as Section 5B. Spans 3 to 45 feet and 40 feet; roadways each 22 feet; heights overall 24 and 14 feet. Total estimated quantities: Class A concrete 449.0 and 128.1 cu. yds.; Class B concrete 152.4 cu.yds.; reinforcing steel 78.770 and 19.350 lbs.; brick masonry 13.2 and 3.4 cu. yds.; structural steel expansion guard 1040 lbs. and two name plates. Address Clifford Older, Chief Highway Engineer, Springfield, Illinois.

Bids will be received in the office of the Department of Public Works and Buildings, Division of Highways, Springfield, Illinois, until April 20, 1923, for the road work designated below:

State Route	Sec.	County	Width	Approx. Length. Miles
12	5	Richland	18	6.60
14	4	Franklin	18	5.55
25	7	Clay	18	3.54
25	21	Douglas	18	7.32
26	2	Ogle	18	5.62
43	1	Mason	18	5.20

BRIDGE SECTIONS

State Route	Sec.	County	Type	Span Ft.
12	5-B	Richland	2 R.C. Bridges	3@ 45 1@ 40

PLANS AND PROPOSALS

Address Department of Public Works and Buildings, Division of Highways, Springfield, Illinois. O. F. Goeke, Dixon National Bank Building, Dixon, Illinois, Ogle County; F. C. Feutz, Colson Bldg., Paris, Illinois, Douglas County; K. N. Evans, 414½ E. Washington St., Springfield, Illinois, Mason County; P. F. Jervis, Record Building, Effingham, Illinois, Clay and Richland Counties; Lloyd Schwartz, Brush Bldg., Carbondale, Illinois, Franklin County.

MICHIGAN

Bids will be received at the office of the Board of County Road Commissioners of Ionia County, Court House, Iona, Michigan, until April 20th, 1923, by Frank F. Rogers, State Highway Commissioner, for the construction of a 35 ft. reinforced concrete girder bridge located on State Reward Route Application No. 10371 at approximately Sta. 58-25 crossing Duck Creek in Section 29, Town 5 N. Range 8 W. in Campbell Township, Ionia County, about 2 miles N. W. of Freeport being bridge file number 340304. The general nature of the work to be done is as follows. Substructure will consist of a 15 ft. 6 in. plain concrete U. abutments which will contain about 198.6 cu. yds. of concrete and about 670 lbs. of steel dowels. Superstructure will consist of a 35 ft. reinforced concrete girder with 20 ft. roadway, at 60 degree angle of crossing. Superstructure will contain about 60.6 cu. yds. of concrete and about 10,950 lbs. of reinforcing steel. Foundations: Soundings indicate clay and gravel. Decision in regard to necessity for piling will be reserved until completion of excavation. Piling will probably not be required. Address Frank F. Rogers, State Highway Commissioner, Lansing, Michigan.

Bids will be received at the office of the Board of County Road Commissioners of Wayne County 1103 Real Estate Exchange Building, Detroit, Michigan, until April 20th, 1923, by Frank F. Rogers, State Highway Commissioner, for constructing a reinforced concrete T-Beam bridge crossing River Rouge in Section 20 and 21 T-1 S. R-10 E, Redford Township, about two miles southwest of Redford and a 85 ft. 9 inch, Pony Truss bridge crossing River Rouge in Sections 4 and 5, T-2 S, R-10 E, Dearborn Township, about three miles northwest of Dearborn, both bridges being on Federal Aid Project Number 87, Wayne County. Separate bids will be received for substructure and superstructure for bridge file number 820303 and for bridge file number 821604 complete, as follows:

Bridge File No. 820303

Substructure will consist of a two 20 ft. 6 in. reinforced concrete U. abutments which will contain about 640.6 cu. yds. of concrete, about 12,050 lbs. of reinforcing steel and about 1,600 lbs. of scrap 80 pound steel rail. Superstructure will consist of one 85 ft. 9 in. Pony Pratt Truss Span, skewed, with curved top chord. A 27 ft. clear roadway with a 56 degree, 27 minutes angle of crossing is provided. Field connections are required to be air rivetted. Field painting will be done by the State Highway Department. Estimated weight of steel is 190,170 pounds.

Bridge File No. 821604

Substructure will consist of two 22 ft. 3 in. plain concrete abutments containing about 510.0 cu. yds. of Grade B concrete, and one 22 ft. 3 in. plain concrete pier containing about 132.0 cu. yds. of Grade B concrete. Substructure will contain about 3,090 lbs. of reinforcing steel. Superstructure will consist of two 43 ft. 8 in. T-beam spans with a 28 ft. roadway at a 90 degree angle of crossing. Superstructure will contain about 190.0 cu. yds. of Grade A concrete and about 42,485 lbs. of reinforcing steel.

Foundations: Soundings at the site indicate that the underlying soil is clay of firm consistency. At the site of the pier, there appears to be a few feet of sand overlying the clay. At the site of the north abutment it will be necessary to excavate through the old road fill, and clay is the underlying soil. Experience in this neighborhood indicates that piles may be necessary.

Address Frank F. Rogers, State Highway Commissioner, Lansing, Michigan.

Bids will be received at the office of the Board of County Road Commissioners of Monroe County, Court House, Monroe, Michigan, until April 27th, 1923, by Frank F. Rogers, State Highway Commissioner, for improving the south 5.3 miles of the following description in Bedford Township; Monroe County,

GOOD ROADS

Title Reg. U. S. Pat, Off.

The Journal of Highway Engineering and Transportation

WITH WHICH IS INCORPORATED

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Colorado To Spend $13,500,000 For Highways

Largest Sum in History of State

Plans of the State of Colorado, of the counties of the state and of the United States government call for the expenditure of more than $13,500,000 for roads and bridges in Colorado during the year 1923, says the "Colorado Highway." This is by far the largest sum ever set aside for the cause of good roads in Colorado. Its expenditure will go far to increase the state's fame for fine roads and will greatly contribute to the betterment of transportation facilities within the state.

The following table shows the agencies which will spend the money and the amount appropriated by each:

State highway department	$ 6,600,000.00
Counties (Counties raised by county road tax)	3,212,519.31
Counties (One half of one cent gasoline tax)	275,000.00
Counties (One half of automobile license fees)	425,000.00
United States government (Federal Aid)	2,636,350.00
Forest Service (forest highway fund)	427,000.00
Total	$13,575,869.31

Included in the sum credited to the state highway department is the balance of the counties' half of the $5,000,000 bond issue, voted in November 1920 and $1,500,000 of the bonds authorized last fall as well as $1,500,000 to be collected from the one-mill state road tax. The balance is made up by balances, state gasoline tax, motor vehicle license fees, etc. The amount to be spent by the United States government will be expended jointly by the state and the United States Bureau of public roads on what is known as federal aid projects. The forest highway fund money will be used for roads which are constructed in the United States forest reserves.

Nothing illustrates better the willingness of the people to tax themselves in order that all the roads in the state may be improved and put in first-class shape than the fact that the counties of the state have decided to raise not less than $3,212,519.31 for roads and bridges. This sum is twice as much as the amount which the counties pay into the state highway fund through the one-mill state road tax and is paid in addition to the latter. All counties levy this special county road tax, with the exception of Denver. Denver does not levy it because it has no highways or county roads within its confines, though the people of the capital city are taxed a little over $400,000 for their mountain parks. A goodly portion of this sum is used for the construction and upkeep of roads.

With the exception of slightly over $800,000 the entire amount raised by the counties in addition to their contribution to the state highway fund is used for betterment of county roads. The $800,000 mentioned is used by the counties to meet a like amount appropriated by the state highway department for the maintenance of state highways.

Montana Awards Contract for New Road Near Hardin

The county Commissioners of Big Horn County are cooperating with the Montana Highway Department and as a result a new contract has been let for about 15 miles of gravel road to reach from Hardin, through Crow Agency and past the Battlefield. Later the work will be continued through Lodge Grass and on to Wyola and the Wyoming line. The first contract will cost $97,000.

There will also be a contract let west of Choteau, Montana, to Glacier National Park to cost $419,000, all Federal aid work and gravel. Yellowstone County has a fine chance to get a contract in their territory amounting to $70,000 all of the C.B-H but up to date the County Commissioners have not met the requirements but the Billings Commercial Club is working on this and we hope to make a favorable report in the near future.

Colorado Section of Lincoln Highway Nears Completion

Preparations are going forward at a rapid rate for the extension of the paving on the Lincoln Highway north from its present extremity two miles south of Fort Lupton, Colorado, through that town and north to Greeley.

The present contract calls for seven and one-half miles, which will bring the paving to a point three miles north of Fort Lupton from where it will be extended through Platteville and thence along the newly-constructed roadbed parallel to the Union Pacific tracks, passing through La Salle and Gilcrest. This will eliminate the winding and dangerous bottom road that has been such a sore spot to motorists. The new survey will strike the present Greeley paving just north of La Salle.

It is expected that all the paving will be completed this season. The

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newly constructed roadbed from Platteville north to Gilcrest and La Salle will be a great improvement to the Weld County roads and will invite more general travel of that strip of highway.

Road Schools Held in Wisconsin

The various county road schools throughout Wisconsin were nearly all held during the month of March and the reports from all parts of the state show a very large attendance. At the opening meeting at Jefferson of the Jefferson county road school, over 300 people were present. The action of the county boards last November in voting large sums for highway improvement, the large attendance at the state road school and the friendly sentiment, and the interest shown at the county road schools indicates that there is no waning in the desire for better roads.

Major W. G. Sloan Appointed New Chief Engineer of N. J.

Under date of April 11th, the New Jersey State Highway Commission appointed Major William G. Sloan of Nutley, N. J., State Road Engineer to succeed Thos. J. Wasser, former Chief Engineer of the New Jersey State Highway Department, who resigned last February.

Major Sloan has resided at Nutley since 1909. He was born in December, 1875, at Ashtabula, Ohio, and received his preliminary education in Chicago Public Schools and the Chicago Manual Training School. He received his higher education at the University of Wisconsin and graduated from Cornell University in 1899. Major Sloan was with the Illinois Central Railroad for about a year after graduation, and then held the position as engineer for two years with the James Stuart Company and was in charge of large projects in construction work for this company. While with this company he was in charge of the foundations and masonry work for the Westinghouse Electric & Manufacturing Co. plant at Manchester, England. In 1902 he became associated with the MacArthur Brothers Co. serving successively as Chief Engineer in 1910 and Vice-President in 1916. In 1917 he became a Major of Engineers and acted as Supervisory Construction Quartermaster in charge of construction of all camps and cantonments at Camp Merritt. At his own request he was sent to France in 1919, and was in charge of large Government operations, also of light railway construction work in the St. Mihiel and Meuse-Argonne sectors. Since his return from the World War, Major Sloan has done private consulting work.

South Carolina Gasoline Tax Amounts to 65,000

February collections from the two cents a gallon tax on gasoline sales amounted to $65,708.10, according to figures furnished by the South Carolina Tax Commission. The amount collected for the preceding eleven months commencing with March was announced to be $487,614.95, making $913,322.69, the total amount collected in the twelve months in which the tax has been imposed.

A the close of the session of the General Assembly in March, 1923, the tax was increased to three cents per gallon. Under the Act as passed a three cents a gallon tax will be imposed upon every gallon of gasoline sold in the State, one cent to go to the State treasury, one cent to the counties for the construction and maintenance of roads, and one cent to the State Highway Department to maintain the highways in the State System without regard to county lines. This Act went into effect upon its approval by the Governor on March 23, 1923.

For the nine and a fourth months of 1923 on the same amount of sales as in 1922, the tax will amount to $1,056,029, and the one-third to the State Highway Department will be $352.010. The total amount of the gasoline tax funds in 1923 will be $1,251,600, upon the same amount of sales as for the past twelve months.

Governor Blaine of Wisonsin Discusses Highways

Governor Blaine in his recent special message to the Wisconsin legislature upon the taxation question briefly referred to the highway program. He urged upon the legislature a rigid economy in highway financing. He called attention to the fact that under the proposed program the sum of $2,200,000 to meet the federal aid now raised from a general property tax would be raised from motor vehicle licenses. It also provides sufficient funds for maintenance of the state trunk highway system so that the counties would be relieved of taxes in the sum of $416,175. He alluded to the fact that there was a proposal to take over 2,500 miles of what are now county trunk highways and add them to the state trunk highway system, which would relieve the counties of the maintenance of these roads and thus save them $500,000, a total saving of $3,416,175. Heretofore real and personal property has borne the burden. Under the proposed legislation it would be borne by levies on the automobile.

Governor Blaine stated that with 10,000 miles on the state trunk highway system, to finish these roads in a 10-year period would require annually $8,000,000. He stated that he did not believe the amount of funds made available for state road purposes should exceed $8,000,000. This is in accordance with the highway bills thus far introduced.

M. W. Watson, State Highway Engineer for Kansas Highway Commission for the past five years left its service April 1, 1923. Prior to holding the position of State Highway Engineer of Kansas, Mr. Watson was Road Engineer for one year, and was connected with the Illinois Department for five years in highway work. His future plans are not yet announced.

Prof. W. K. Hatt, director of the Advisory Board on Highway Research of the National Research Council, sailed for Europe on Mar. 17. He will make a study of highway development in several countries there and will attend the International Road Congress, to be held in Seville in May. He will return to the United States early in June.

Kentucky Approves Use of Bankable Securities as Contract Surety

Kentucky State Highway Commission has made a change in the form of contract bond requirements which will apply to the letting of contracts hereafter. Heretofore the regulations of the department have stipulated that the contract bond shall be executed by a corporate surety. In future the same form of bond will be acceptable but the contractor is given the option of furnishing personal bond with bankable collateral.

In the notice of this policy, Joe S. Boggs, State Highway Engineer, says—"This form of bond will be acceptable to this department, it being left, however, optional with the successful bidder whether he desires to execute a surety bond or take advantage of this method." It is permissible under the law for highway contractors to execute a personal bond for the faithful performance of their contracts, provided that at the time they enter into contract and execute such a bond they deposit with the state treasurer as additional security a certified check or gilt-edge securities in the amount of twenty per cent of their total contract price, such securities to be retained by the treasurer until the contract has been completed or until the retained percentage equals twenty per cent of the contract."

Concrete Pavements in Atlanta Finished with Rubber Hose

With a construction program for 1922 of 500,000 sq. yd. of concrete pavement, the City of Atlanta, Ga., made rapid strides in making up for the small amount of paving done during the war period. Most of this work was the replacement of worn-out surfaces with concrete. In addition to the yardage placed by the City of Atlanta, approximately 175,000 square yards were built by Fulton County, a great portion of which lies within the city.

Finishing with a rubber hose after the concrete has been rolled is a feature of the construction methods used in Atlanta. After the concrete has been deposited on the subgrade and brought to proper contour, it is rolled with a standard 6 ft. roller of 10 in. diameter. The final finish is secured with a half-inch rubber hose considerably longer than the width of the pavement. This is dragged over the surface of the concrete, several trips being made each way. A gritty surface similar to that given by the belt is obtained, but the work is much easier.

Street improvement in Atlanta is under the jurisdiction of the City Council. The work is done under the supervision of H. L. Collier, Chief of Construction, and his principal assistant, Max Hall. Paving done inside the city limits by the county was placed under the supervision of the Board of Public Works of which Oscar Mills is Chairman.

Douglas county, Wisconsin, spent $503,363 in the construction and maintenance of its highways, state highways and bridges during 1922, according to an outlined report just completed at Superior by Conrad Hanson, county highway commissioner. Eighty-eight miles of road were graded, and 46 miles of road were graveled and clay surfaced. Seventeen bridges were built.

Canada is Increasing Use of Motor Vehicles

Statistics concerning the registration of motor vehicles for the year 1922 in Canada indicate that the steady increase in their number is still going on. For the whole of Canada the increase in registration for 1922 over 1921 was 9.5 per cent. In Ontario it was 18 per cent. An interesting feature of the growth in Ontario has been that while the total registration of motor vehicles increased by 18 per cent. the registration of motor trucks alone increased 23 per cent. thus indicating that the number of trucks is growing more rapidly than that of other motor vehicles. Since 1916 the growth in registration of all motor vehicles in Ontario has been 343 per cent., whereas for trucks alone it has been 82 per cent.

Comparison of our registration figures with those of the United States indicates that in some parts of Canada at least the use of motor cars is increasing more rapidly than in the country of their chief popularity. We have yet a considerable way to go in Canada to become as nearly saturated with motor cars as they are in the United States. Whereas, in the latter country there is one motor vehicle for each 10 persons of population, in Canada we have only one for each 17.

Brockville-Gananoque Highway to be Finished

It is expected that the Ontario provincial highway from Brockville to Gananoque, will be completed by the end of the coming season. For the entire distance grading has been for some time past completed and the contract for laying a macadam base course on a section between the Escott town line and Yonge Mills will be let shortly. This stretch of four miles is the only one upon which macadam has not been laid.

Missouri Has $28,000,000 Worth of Road Construction Under Contract

Missouri now has under contract approximately $28,000,000 worth of work, and will in the near future let probably $5,000,000 more. The lettings from now on will be small and will consist of short sections of grading and bridges throughout the state and will improve the state system so that it is possible to more effectively maintain the state roads.

The department is now seriously considering the material situation, and hopes to relieve the scarcity by opening up pits and plants at different points in the state. The department is allowing payments for material storage in accordance with the following statement, which was recently issued.

The Missouri State Highway Commission will pay on monthly estimates 90 per cent. of the invoice value, including freight to destination of all cement, coarse aggregate, fine aggregate, reinforcing steel, steel central joint, and structural steel that is placed in storage for use on State and Federal-aid projects subject to the following conditions:

1. Cement shall be stored in compliance with the instructions issued.
2. No payment will be allowed for materials delivered where the value of the total amount of all materials stored for the job is less than $500.
3. The cost will be determined by adding the cost of materials at origin minus cash discounts taken, and the freight rate to the point of delivery. If storage is made out on the road that is to be built, a cost for hauling, computed on the basis of 25 cents per ton mile, will also be allowed.
4. The weight of sand and gravel will be assumed to be 1.35 tons per cubic yard, and of crushed stone 1.22 tons per cubic yard. The value of cement will be computed after deducting the value of the sacks.
5. Payments for reinforcing steel and central joint will be made only provided the contractor furnishes suitable storage protection from the

weather. Charges for construction of such storage will not be allowed.

6. The cost of material produced from local sources by the contractor shall be computed by adding the actual cost of producing the material, a depreciation charge of not to exceed 20 per cent, of the value of equipment used in production and a profit of not to exceed 20 per cent. of the actual cost of production. If the material is stored on the road that is to be built, a haulage cost of 25 cents per ton mile will also be included.

N. Y. to Require Guarantee of Bank on Highway Work

Owing to the number of contractors who through lack of sufficient capital have failed to complete highway contracts undertaken for the State, Commissioner Frederick Stuart Greene has ruled that hereafter before the contract is awarded the successful bidder must present written evidence from a bank showing his financial responsibility. The department will require that a contractor shall be able to show resources amounting to at least 10 per cent of the total contract price.

This ruling meets the general approval of experienced contractors, who believe that this new requirement will result in a material benefit to the State and to responsible contractors.

Canadians to Ask Federal Aid for Highways

To urge upon the Dominion government the necessity of at least doubling the yearly grants for good road construction, a deputation representing the Canadian Good Roads Association recently urged the Dominion government to increase the next five year appropriation from $20,000,000 to $50,000,000, which, with the additional sixty per cent. of the total roadway cost the province, would provide, would make the total amount expended jointly on the roadways of Canada by the Dominion and provincial authorities during that period reach a grand total of $115,000,000, or $23,000,000 annually. While at first glance this may seem a rather formidable total, it does not continue to look so when compared with what other countries have undertaken. The United States, for instance, will have expended half a billion dollars during the period 1916 to 1925.

Utah Has Big Road Problem

Some of the Western States have problems of road financing that can hardly be appreciated by the Eastern States. In Utah, for instance, according to a statement by William Peterson, former state road commissioner and now director of the Experimental Station, only 3 per cent of the land in the state is being farmed and only 18 per cent is privately owned, and yet roads are demanded leading to all parts of the state. The state now has invested in its roads bonds alone amounting to more than $16,000,000 or 2½ per cent of the total valuation of the state.

Mr. Peterson states that money spent in roads depreciates faster than any other form of legitimate expenditure. Investment in an earth road may be absolutely obliterated within five years unless the road be properly maintained. He estimates that the state will have to spend $500,000 a year to protect its present investment in roads of about $18,000,000.

Canadian Engineers Urge Standardized Traffic Signals on Highways

Meeting at Ottawa on April 9, a sectional committee of the Canadian Engineering Standards Association discussed the question of uniform traffic signals for highways. The chair was taken by A. W. Campbell, Dominion Commissioner of Highways, and there were also present the following: A. F. MacCallum and Chief Ross of Ottawa; J. A. Begin, Quebec; A. C. McKenzie, J. A. Ellis, G. Gordon Gale, J. H. King, Hon. F. C Biggs, W. A. McLean, Dr. P. E. Dolittle and J. H. Duchastel.

In opening the meeting, the chairman explained that the committee had been formed with the view of obtaining agreement among the provincial governments, municipal, railway, automobile and other authorities concerned in regard to traffic signals on highways and on motor vehicle, so as to get rid of the many local divergencies which now exist. It was also hoped to work in co-operation with a similar committee which is being formed under the auspices of the American Engineering Standards Committee and is dealing with similar problems in the United States.

After considerable discussion, it was decided to place the work in the hands of three working sub-committees, dealing respectively with highway signals at level crossings, signals on vehicles and danger and direction signals on highways. It was further decided to cooperate as far as possible in each case with the corresponding committee of the American Engineering Standards Committee, with the view of obtaining as far as possible uniformity in practice between the two countries. The sub-committees were requested to report at the next meeting of the sectional committee, to be held at the time of the annual convention of the Canadian Good Roads Association in June in Hamilton.

Manitoba Has 3000 Miles of Good Roads

In the Province of Manitoba the facilitation of rapid transit has primary regard, and road development, a pure provincial enterprise, has in no way lagged behind the times. Prior to 1914 certain Government assistance was extended for the improvement and building of roads. It was of a too restricted form, however, and incompatible with rural and urban development, and so in 1914 the "Good Roads Act" was put on the statutes with its initial appropriation of $5,000,000.00.

The provisions of this Act are comprehensive and wide. The initiative is with the Municipalities, who, to come under its benefits, first apply to bring roads, or system of roads under the Good Roads Act. Considerable attention is being given to the establishment of Main Roads or Provincial Highways and to this end the Government pays the larger share in the cost of the work thereof, viz., 66 2/3 per cent

Various associations have been urging the entire completion of the Lord Selkirk Highway, which is the main road connecting Winnipeg with the United States, and a scheme is now under consideration for the consummation of that much desired project which will, no doubt, open the door to large tourist traffic and be an added asset to the Province of Manitoba.

During the war period, progress on road construction was necessarily restricted, but since the cessation of hostilities rapid strides have been made and today there are 505 miles of Provincial Highways and 2,476 miles of Market Roads—a total of 3,001 miles built to the standard required by the Highway Commissioner. Of the foregoing total 1,133 miles have been surfaced with gravel and 25.5 miles are paved roads.

The following structures have also been built:

Reinforced Concrete Bridges and Culverts	635
Steel Bridges	36
Timber Bridges	123
Timber Bridges on Permanent Abutments	11
Total	805

Expenditures to the end of August, 1922, are set out as follows:

Classification	Amount Expended	Government Share Paid
Market Roads	$5,121,788.16	$2,323,917.55
Provincial Highways	1,789,856.30	1,218,646.09
Pavements	984,799.98	324,757.50
Bridges and Culverts	1,286,476.33	609,519.87
Totals	$9,182,920.77	$4,476,841.01

Since the passing of the "Canada Highways Act," the Good Roads Department has endeavored to complete as many projects as possible in order to secure its quota of $1,602,265.00. Work has already been done which should entitle the Province to $489,685.06, but it is not anticipated that suffifficient can be accomplished before the expiration of the grant in 1924 to absorb the allotted amount.

Louisiana Spends Over $4,000,000 on Highways During 1922

The Highway Commission of Louisiana spent more than $4,000,000 in 1922, included in this being parish funds and Federal aid. About 90 per cent, of the highways constructed last year were surfaced with gravel and the remainder with shell, Uvalde rock asphalt and bitulithic.

Soil carrying large amounts of iron is found in the northwestern part of the State which has been used as a binder instead of clay and is believed to be superior to it. By using this local material the roads have been built at a saving of from $2,000 to $3,000 a mile. Material said to contain 75 per cent metal is being used on some of the highways as a base course. The city pays about 10c. a yard royalty for this material as against $1.00 a yard for freight on sand-clay and gravel.

It is stated that by the end of 1923 six cross-state highways will be nearing completion.

Indiana Road Commission Opens Supply Bids

The Indiana Highway Commission recently opened bids for a year's supply of gasoline, lubricating oil and grease, and received proposals from fourteen companies. Before attempting to determine which made the lowest bids, the commission will undertake to standardize a form under which the proposals may be classified. Some of the bids were on gasoline, some only on oils and others on grease, while still others were on all of these items.

The bidders were: Laporte Independent Oil Co., Sinclair Refining Co., Western Oil & Refining Co., Hawkeye Oil Co., Gulf Refining Co., Indian Refining Co., Alemite Lubricating Co., Standard Oil Co. of Indiana, Great American Gas Co., National Refining Co., Campbell Oil Co., Sun Oil Co., Independent Oil Co.

The bids were made on 1,500,000 gallons of gasoline, 100,000 gallons of lubricating oil and 70,000 gallons of hard grease. The commission's estimate on the supply is about $350,000.

The commission will on May 8 receive bids on five roads, to receive bitumen surface treatment or to be surfaced with bituminous macadam. This work will cover 17 miles and includes the following: From New Albany north one mile, on state road No. 16; from New Albany northwest five miles, on state road No. 42; from Jeffersonville north seven miles, on state road No. 1; from the Harrison-Floyd county line east two miles to Greenville. The work must be completed by November 15.

New York Changes Concrete Road Specifications

The State of New York has just adopted new specifications for concrete pavements. Frederick S. Greene, highway commissioner, describes the advantages of the new specifications as follows:

"(1) We have done away with the crown sub-base, which as you know, is exceedingly difficult to roll and which I do not believe has ever been a practical proposition for the contractor.

"(2) We have increased the thickness of the slab at the outer extremities, where the greatest strain comes when two heavily loaded trucks pass each other on the pavement.

"(3) We have continued the parabolic crown for the outer surface so as to do away with the short angle at the center joint which two flat planes would give.

"(4) We have cut down on the weight of the reinforcement mesh, using now but 40 lb. per 100 sq. ft. We also give the contractor the option between mesh and assembled bar mats.

"(5) In addition to U bars at the expansion joints, we are running longitudinal bars 6 in. from the outer edge of the slab. We are going to place expansion joints at 40 ft. intervals."

California Has 44,775 Miles of Improved Roads New Hampshire 1.955

California now has 44,775 miles of improved road not including that added during last season, according to the Bureau of Public Roads, United States Department of Agriculture, which has made a complete census in the state. The improved road mileage at the beginning of 1922 was as follows:

Graded and drained	30,499
Sand-clay	240
Gravel, chert and shale	7,087
Water-bound, macadam	533
Surface-treated macadam	1,355
Bituminous macadam	701
Sheet asphalt	585
Bituminous concrete	493
Cement concrete	2,613
Miscellaneous	699

The total road mileage of the state is 75,889 miles, as compared with 61,039 miles in 1914, and during the seven-year period from 1914 the surfaced and paved roads have increased from 10,280 to 14,275 miles.

The total income for highways in 1921 amounted to $49,691,895 or $319 for each square mile of area, $655 for each mile of road, or $14.50 per capita.

New Hampshire now has 1,955 miles of improved road not including that added during last season, according to the Bureau of Public Roads, United States Department of Agriculture, which has made a complete census in the state. The improved road mileage at the beginning of 1922 was as follows:

Graded and drained	263
Gravel, chert and shale	1,368
Water-bound macadam	66
Surface-treated macadam	123
Bituminous macadam	50
Bituminous concrete	29
Cement concrete	1
Miscellaneous	55

The total road mileage of the State is 13,841 miles, as compared with 14,020 miles in 1914.

The total road revenue in 1921 amounted to $3,882,388 or $430 for each square mile of area, $280 for each mile of road, or $8.76 per capita.

HIGHWAY CONTRACT NEWS

ALABAMA

Bids will be received by the State Highway Commission of Alabama at the office of the State Highway Department, Montgomery, Ala., until May 1, 1923, for the construction of a road between the Dale County line and the Florida State Line by way of Dothan, in Houston County. The length of road to be constructed is 22.02 miles and the principal items of work are approximately as follows: 124961 cu. yd. common excavation, 26787 sta. yd. overhaul on excavation, 151 lin. ft. culvert pipe to be relaid, 168.5 cu. yd. Class "B" concrete headwalls, 355.56 cu. yd. Class "A" concrete culverts, 31534 pounds reinforcing steel in culverts, 3712 lin. ft. ¾ in. guardrail cable. Gravel surfacing, Station 527 to Station 1155-07, 31850 cu. yd. gravel surfacing within one mile, 145000 ½ mi. units overhaul on gravel and clay binder, 122000 sq. yd. mixing sand, gravel and clay. Sand clay surfacing, Station O to Station 527. 33000 cu. yd. sand clay within one mi., 5000 ½ mi. units overhaul on sand clay, 5000 cu. yd. stripping clay pits, 15000 sq. yd. mixing sand and clay. Bridges. 94168 F. B. M. treated timber structures, 6310 lin. ft. treated timber piles, 708 sq. yd. 1⅛ in. bit. surfacing, cold mix.

Bids will be received by the State Highway Commission of Albama at the office of the State Highway Department, Montgomery, Alabama, until May 1, 1923, for the construction of a road beginning at Florala and ending at Federal Aid Project No. 136, west of Opp. The length of road to be constructed or improved is approximately 25 miles and the principal items of work are approximately as follows: 248407 cu. yd. common excavation, 15930 sta. yd. overhaul on excavation, 3200 cu. yd. gravel surfacing in town of Opp, 84000 cu. yd. sand clay surfacing, 20000 cu. yd. stripping clay pits, 60000 sq. yd. mixing sand and clay, 127.79 cu. yd. Class "B" concrete headwalls, 857.22 cu. yd. Class "A" concrete culverts, 76780 pounds reinforcing steel in culverts, 67500 sq. yd. Bermuda grass planting, 22736 lin. ft. ¾ in. guard rail cable. Bridges—1 80 ft. steel span complete in place, 100 cu. yd. Class "A" concrete, 45.5 cu. yd. Class "B" concrete, 2900 lb. reinforcing steel, 129,780 F. B. M. treated timber structures, 3200 lin. ft. treated timber piles, 560 lin. ft. untreated foundation piles, 110 cu. yd. dry excavation, 11,054 lb. structural steel.

Bids will be received by the State Highway Commission of Alabama, at the office of the State Highway Department, Montgomery, Ala., until May 1, 1923, for the construction of a road between Evergreen and Belleville. The length of the road to be constructed or improved is 10.02 mi. and the approximate quantities of work are as follows: 63,527 cu. yd. common excavation, 18,000 cu. yd. local gravel within one mile, 140,000 ½ mi. units overhaul on gravel, 65.29 cu. yd. Class "B" concrete in headwalls, 167.98 cu. yd. Class "A" concrete in culverts, 16,204 lb. reinforcing steel in culverts. Bridges—148,606 F. B. M. treated timber structures, 5438 lin. ft. treated timber piles, 4450 lb. reinforcing steel, 1 65 ft. steel span complete in place, 1506 sq. yd. 1½ in. bit. surfacing, cold mix.

COLORADO

Bids will be received by the State Highway Department of Colorado until May 10 for the construction of Colorado State Project No. 789, which consists of a 204 ft. timber trestle bridge and approaches over Rattlesnake Creek, about 4½ mi. east of Byers, Colo., in Arapahoe County.

Bids will be for the following classes of work: 1. Creosoted timber piling, 1392 lin. ft., 2. creosoted timber, 32.42 M. bd. ft., 3. Untreated timber, 22.472 M. bd. ft.

Bids will be received by the State Highway Department of Colorado until May 10, 1923, for the construction of State Project No. 775, which consists of a 24 ft. I-beam bridge with approaches over Bear Creek between Troutdale and Bendemeer, Jefferson County, Colorado.

Bids will be for the following classes of work: 1. Excavation, common, 850 cu. yd., 2. Excavation, rock, 50 cu. yd., 3. Borrow fiill 700 cu. yd., 4. Class "A" concrete, 28 cu. yd., 5. Cement rubble masonry, 109 cu. yd., 6. Reinforcing steel, 2670 lb., 7. Structural steel, 10,150 lb.

Bids will be received by the State Highway Department of Colorado until May 10, 1923, for the construction of Phipps Bridge—Jefferson County Bond Project, which consist of a 20 ft. I-beam bridge and approaches over Bear Creek, between Troutdale and Bendemeer, Jefferson County.

Bids will be for the following classes of work: 1. Class "A" concrete, 24 cu. yd., 2. Cement rubble masonry, 95 cu. yd., 3. Reinforcing steel, 2270 lb., 4. Structural steel, 6,760 lb.

ILLINOIS

Bids will be received until May 2, 1923, at the Court House in Toulon, Illinois, for the construction of one slab bridge to be built in Valley Township, Stark County, J. L. Duran Acting Co. Supt. of Highways, Toulon, Illinois. Span 24 ft. roadway 16 ft., height over all 14 ft. Total estimated quantities, Class A concrete 78.4 cu. yd., reinforcing steel 7810 lb.

Bids will be received until May 5, 1923, at the Court House in Woodstock, Illinois, for the construction of one steel truss on concrete abutments to be built in Seneca Township, McHenry County; C. L. Tryon, Co. Supt. of Highways, Woodstock, Illinois. Span 70 ft., roadway 16 ft., height over all 16 ft. Total estimated quantities Class A concrete 89.0 cu. yd., Class X concrete 24.2 cu. yd., reinforcing steel 12,440 lb., structural steel 46,750 lb.

Bids will be received until May 1, 1923, at the Court House in Urbana, Illinois, for the construction of one reinforced concrete bridge to be built between Philo and Silney Townships, Champaign County; R. F. Fisher, Co. Supt. of Highways, Urbana, Illinois. Span 28 ft. along center line, 25° skew; roadway 20 ft., height over all 14 ft. Total estimated quantities Class A concrete 104.3 cu. yd., reinforcing steel 11,810 lb.

INDIANA

Bids will be received by the Director of the State Highway Commission, at the office of the State Highway Commission, in the State House, City of Indianapolis, Indiana, until May 1, 1923, for the construction of certain highways and described as follows: No. 1. F. A. 49, Sec. B, Lagrange-Angola Road, 5 mi. west of Angola to Angola, Steuben County, 4.681 mi. No. 2. F. A. 52, Sec. B, Dixie Bee Line, Youngstown to Terre Haute, Vigo County, 4.090 mi. Bids will be received for three types of pavement—Brick, Bituminous Concrete and Concrete on the above listed projects, as shown on plans and described in standard specifications for same.

MAINE

Bids for building ten sections of State highway will be received by the State Highway Commission at its office in the State House, August, Maine, until May 2, 1923. Bituminous Macadam or Gravel Surface, three sections as follows: Norridgewock and Skowhegan, 4.30 mi.; Casco, 4.53 mi.; Northport and Belfast, 2.81 mi. Gravel Surface, seven sections as follows: Presque Isle, 6.25 mi.; Perry, 3.16 mi.; Woodstock and Paris, 3.22 mi.; New Sharon, 3.42 mi.; Passadumkeag, 2.32 mi.; Lincoln, 3.27 mi.; and Edmunds, 2.92 mi.

NORTH DAKOTA

Bids for the construction of a state highway from Fredonia north will be received by the State Highway Commission and Board of County Commissioners at the Court House at Napoleon, North Dakota, until May 4, 1923. Contemplated work consists of 14.0 mi. of earth road improvement involving approximately 98,047 cu. yd. earth excavation, 4080 cu. yd. rock excavation, 9475 cu. yd. Stas. overhaul, 1150 cu. yd. riprap, 283 sq. yd. cobble gutter, 4750 lin. ft. wire rope guard rail, 381 wood guard posts, 336 panels snow fence, hauling and installing and furnishing and deliverng metal pipe culverts as follows: 2392 lin. ft. 18 in. diam., 520 lin. ft. 24 in. diam., 156 lin. ft. 30 in. diam., 48.59 cu. yd. Class A concrete and 3392 lb. metal reinforcement.

Bids for the construction of a state highway north and west of Velva will be received by the State Highway Commission and Board of County Commissioners at the Court House at Towner, North Dakota, until May 1, 1923. The contemplated work consists of 4.397 mi. of earth road improvement involving approximately 30,010 cu. yd. earth excavation, 1300 cu. yd. rock excavation, 242 cu. yd. riprap, 2744 lin. ft. wood guard rail, 93 wood guard posts, 225

GOOD ROADS

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What the Arlington Investigations Are Showing

The Value of Experimental Road Building Outlined

By A. T. GOLDBECK

Chief of the Division of Tests, U. S. Bureau of Public Roads

IT has been pointed out in previous papers by the writer that the experiments being conducted by the U. S. Bureau of Public Roads at the Arlington Experiment Station in Virginia are aimed primarily at the obtaining of information which is of importance in connection with the structural design of roads and they include also special investigations in road materials. Let us first consider the investigations made in connection with road design taking them up one by one in enough detail to outline their purpose, to show briefly the test procedure and finally to show the significance of the results obtained.

A road, considered as a structure, consists of a slab, either rigid or flexible, supported on the underlying subgrade and carrying concentrated loads. The degree and character of support offered by the subgrade of course are widely varying, depending upon the nature of the soil, the amount of moisture present and other factors, and the design of the surface must, therefore, always be considered in conjunction with the subgrade upon which it is supported. The Arlington experiments for this reason include a number of investigations of the subgrade and methods for draining it. The problem of structural design of the surface involves a number of problems in the mechanics of the slab as well as problems in the mechanics of the loads applied. It is our aim as a result of these investigations to develop a definite and rational method for the actual design of pavement surfaces.

What the Investigations of the Subgrade Show

The following questions naturally arise in connection with the subgrade: (1) What are the physical characteristics of a satisfactory and of an unsatisfactory subgrade material? (2) How can we improve a poor subgrade material to render it satisfactory? (3) What are the factors controlling moisture in the subgrade and what system of drainage should be used for different conditions?

It is a matter of common observation that soils vary widely in character. Some soils are composed of particles in an extremely fine state of sub-division, others of particles approaching the size of boulders and there are all of the variations between these extremes. Some soils are capable of taking up vast quantities of water and when they do so they might swell tremendously in volume and shrink correspondingly when they again dry out. On the other hand other soils can retain but little moisture which changes their volume inappreciably. Some of these soils with a certain amount of moisture present are very easily deformed, in other words, they have low bearing value. Others are capable of supporting high intensity of load. If a road is to be actually designed we should through suitable tests be able to forecast how the subgrade is going to act and our surface design should then be controlled accordingly.

For this reason we have developed a series of laboratory tests for predicting the behavior of the subgrade by determining its physical characteristics. They are as follows:

1. Mechanical Analysis
2. Water Holding Capacity
3. Moisture Equivalent
4. Volumetric Change
5. Vertical Capillarity
6. Comparative Bearing Value
7. Slaking Value
8. Dye Adsorption

These tests have all been described in detail. Very briefly they are made as follows:

Mechanical Analysis—This test consists of separating the sample by sieving and washing, into sand, silt, clay and suspension-clay. For our purpose sand is that portion of the sample which passes a 10 mesh sieve and which is retained on a 200 mesh sieve but which settles out of a mixture of soil and water after 8 min. subsidence to a depth of 8cc. from the surface of the liquid.

Silt is that portion of a soil sample which passes a 200 mesh sieve and which settles out of a mixture of soil and water after 8 min. subsidence to a depth of 8cc. from the surface of the liquid.

Clay is that portion of the soil sample which remains in suspension after 8 minutes subsidence to a depth of

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8 cc. from the surface of the liquid but which is thrown down when a centrifugal force equal to 500 times the force of gravity is exerted upon the suspended material for a period of ½ hr.

Suspension-clay is that portion of the soil sample which remains in suspension when a centrifugal force equal to approximately 500 times the force of gravity is exerted upon the suspended material for a period of ½ hr. This is the very finest portion of the soil sample.

Water-holding Capacity. The water-holding capacity of the soil is the maximum percentage of water which it is capable of retaining.

Moisture Equivalent. The moisture equivalent of the soil is the percentage of moisture which is retained by the soil after it has first been saturated and then subjected to a centrifugal force equal to 1000 times the force of gravity for a period of 1 hr. This seems to be a very important test and is a measure of the difficulty of drainage.

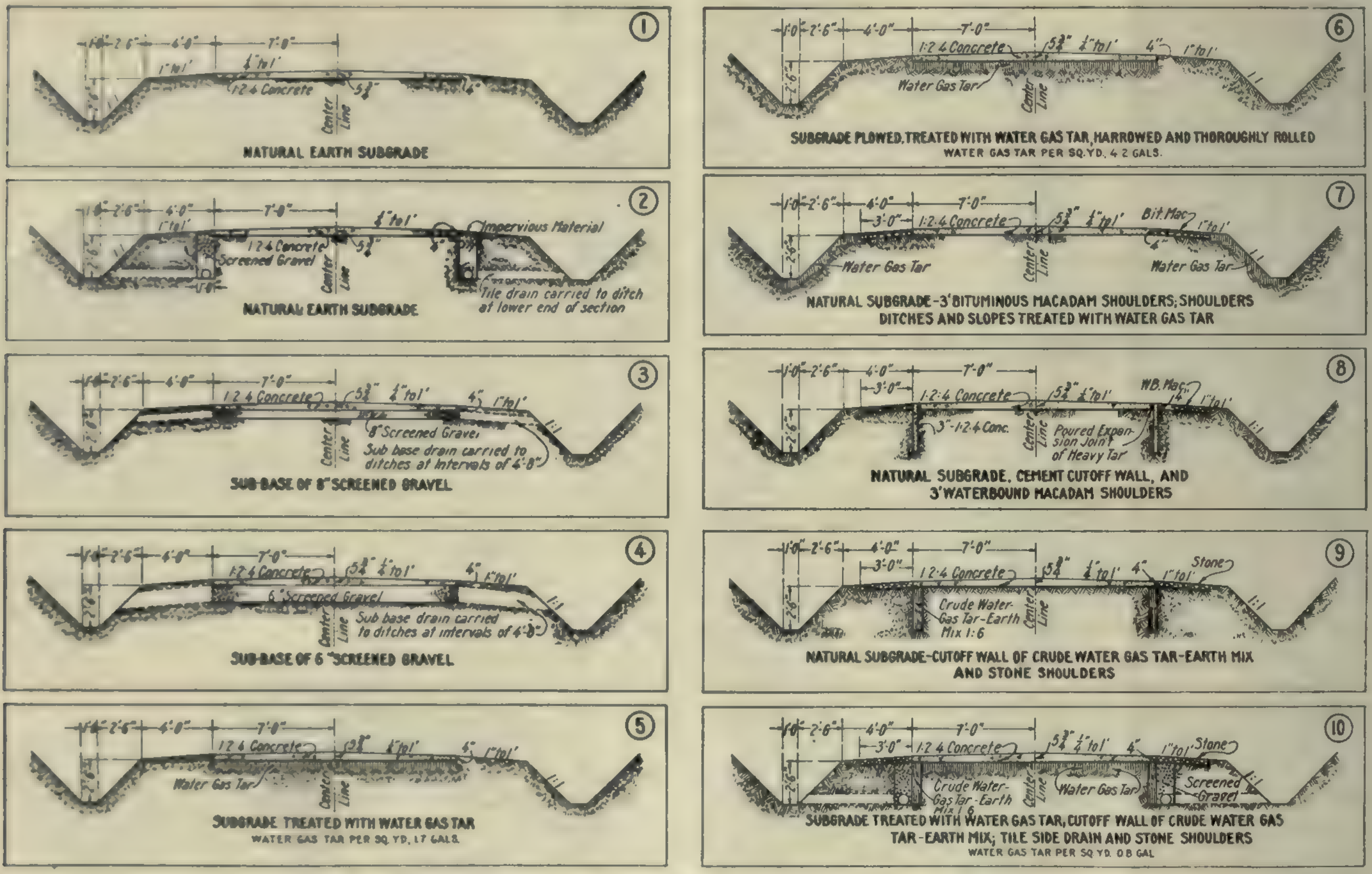

①
1'0" 2'6" 4'0" 7'0"
1"to1'
¼"to1'
1:2:4 Concrete
5¾"
Center Line
NATURAL EARTH SUBGRADE
②
Impervious Material
1:2:4 Concrete
Screened Gravel
Tile drain carried to ditch at lower end of section
NATURAL EARTH SUBGRADE
③
8" Screened Gravel
Sub base drain carried to ditches at intervals of 4'-8"
SUB-BASE OF 8" SCREENED GRAVEL
④
6" Screened Gravel
Sub base drain carried to ditches at intervals of 4'-8"
SUB-BASE OF 6" SCREENED GRAVEL
⑤
Water Gas Tar
SUBGRADE TREATED WITH WATER GAS TAR
WATER GAS TAR PER SQ. YD. 1.7 GALS.
⑥
Water Gas Tar
SUBGRADE PLOWED, TREATED WITH WATER GAS TAR, HARROWED AND THOROUGHLY ROLLED
WATER GAS TAR PER SQ. YD. 4.2 GALS.
⑦
Bit. Mac.
Water Gas Tar
NATURAL SUBGRADE-3' BITUMINOUS MACADAM SHOULDERS; SHOULDERS DITCHES AND SLOPES TREATED WITH WATER GAS TAR
⑧
WB. Mac.
3"-1:2:4 Conc.
Poured Expansion Joint of Heavy Tar
NATURAL SUBGRADE, CEMENT CUTOFF WALL, AND 3' WATERBOUND MACADAM SHOULDERS
⑨
Stone
Crude Water-Gas Tar-Earth Mix 1:6
NATURAL SUBGRADE-CUTOFF WALL OF CRUDE WATER GAS TAR-EARTH MIX AND STONE SHOULDERS
⑩
Stone
Crude Water-Gas Tar-Earth Mix 1:6
Water Gas Tar
Screened Gravel
SUBGRADE TREATED WITH WATER GAS TAR, CUTOFF WALL OF CRUDE WATER GAS TAR-EARTH MIX; TILE SIDE DRAIN AND STONE SHOULDERS
WATER GAS TAR PER SQ. YD. 0.8 GAL

Fig. 1. Types of Drainage Tested by U. S. Bureau of Public Roads.

Vertical Capillarity—In this test the percentage of moisture taken up by a given quantity of the soil by vertical capillarity is determined.

Volumetric Change—This test is one to determine the amount of shrinkage of the soil from a definite moisture condition to an air-dried condition.

Comparative Bearing Value Test. In this test the load supporting value of the soil is determined.

Dye Adsorption Test. Different soils have the ability in greater or lesser degree of decolorizing dye solutions which are filtered through them and the variability of dye adsorption properties by soils seems to be correlated with variability of other properties.

Slaking Value. In this test the length of time is determined for a briquet of definite size to fall to pieces when immersed in water.

It has been necessary for us to conduct a large number of tests in order to standardize the methods of investigation and having the tests now standardized a number of samples of soils from poor and good subgrades have been analyzed and the results tabulated. In addition artifical subgrade samples have been prepared by mixing sand with clay in various proportions. As a result of these investigations at the present time we feel warranted in making the following statements:

1. Soils which resemble each other vary closely, in fact those having practically the same mechanical analysis, may be entirely different from the point of view of their physical properties, that is, their bearing values, moisture contents and volumetric changes. This is due to the difference in character of the clay content of these soils. We determine this difference in character by means of the dye absorption test, having found that soils, although they may appear alike, will react very differently to the dye adsorption test.

2. We find that the character and quantity of clay in a soil materially affects its ability to take up moisture by capillary action and to retain it under the action of a centrifugal force equal to that of 1000 times the force of gravity. Soils whose clay content is approximately the same may take up entirely different capillary moistures due to the character of the clay content. They may also have entirely different volumetric changes due to the character of the clay content.

3. The factors which control the bearing values of soils have not been completely established as yet although the following points are worthy of consideration.

(a) When the moisture index of the soil is less than unity the bearing value will be high.

(b) When the moisture index of the soil is above unity high bearing values can be obtained provided the absorption of the soil is high.

(c) Soils whose moisture index is greater than unity and whose absorption is low can almost invariably be expected to have low bearing values.

The above three statements apply to bearing values obtained with bearing areas of several square inches. Larger bearing areas are being investigated.

Since the road surfacing is supported on the subgrade one very important phase of the tests of subgrade materials has been to find out how to make a test for bearing value which will be at all applicable to road conditions. It must be remembered that when the road surfacing carries a heavy concentrated load it deflects under the load and compresses the subgrade over an area of several square feet. It is also true that when the road slab deflects this deflection is quite small, generally not over 0.1 in. In other words, a bearing value test to represent road conditions, will probably have to be made with a bearing area of several square feet and the bearing value should be determined under the penetration of that bearing area of not more than 0.1 in. We have completed a large number of such test results and without going into the details of the test the results obtained can be stated that they show very plainly that the bearing value of a soil having penetrations of the bearing block equal to 0.1 in. varies greatly with the size of the bearing block and that when small bearing areas are used the results are far higher and not at all indicative of the bearing value of the soil for supporting the pavement. This is very important for it points out to us the futility of attempting to make bearing value tests for roads with bearing areas having less than two square feet.

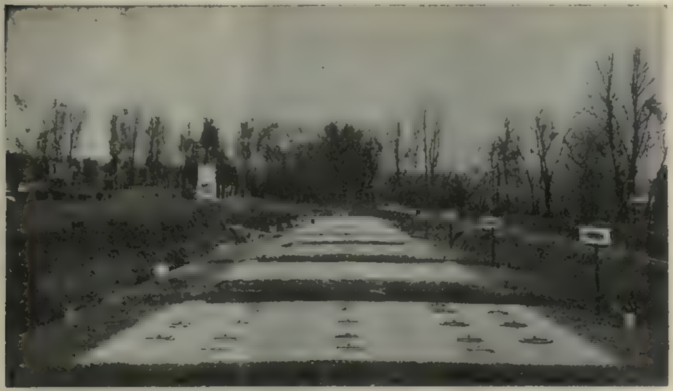


FIG. 2. PAVEMENT SECTIONS UNDER TEST AT ARLINGTON.

Curing of Poor Subgrades

In a number of sections of the country we are forced to build roads on soils which we know will cause trouble unless their moisture content can be greatly reduced or in some cases unless the moisture content can be kept at a fairly constant value. It is not at all impossible that such subgrade materials can be cured of their undesirable properties by the use of admixtures .

Two of the most important characteristics of the subgrade are: (1) That it shall have high bearing value and (2) that it shall have low volumetric change and if admixtures to poor subgrade materials will produce these results they will be beneficial. Both hydrated lime and Portland cement greatly decrease the volumetric change of a poor soil and very greatly increase the bearing value so that such admixtures are most decidedly of benefit. There are other materials which are also beneficial such as sand and other granular materials and possibly light bituminous materials which are readily miscible with the soils. The economics of such a procedure in comparison with increased thickness of road surfacing must be studied for each individual case.

A series of experiments have also been conducted on ten different types of drainage (See Fig. 1). The slabs were subjected to normal moisture conditions and then the side ditches were filled in and the slabs were sprinkled to simulate heavy rain fall and as a result of these experiments thus far the following conclusions are drawn: (1) Tile drainage will only remove water in excess of capillary moisture. Their field is confined entirely to the removal of free water in the soil. (2) A low temperature at the surface accelerates the movement of capillary moisture. This probably helps to account for the accumulation of high moisture content in the subgrade immediately under the pavement during cold weather. (3) It cannot be said that any of the methods of drainage thus far tried are successful in keeping the moisture content low at all seasons of the year. It is believed that in certain types of soils no type of drainage thus far practised will be entirely successful in reducing the moisture content to the desired amount and in those cases resort must be had to admixtures or to strengthened pavement surface design.

Static Load Tests of Concrete and Broken Stone Bases

Preliminary investigations have likewise been completed to determine the static load supporting value of different thickness of broken stone base and different thickness of concrete base supported on a very wet clay subgrade and on a dry sand subgrade. This series of investigations was started to determine something of the laws governing base thickness for supporting loads of different magnitude. In the case of the broken stone bases the wet clay sub-

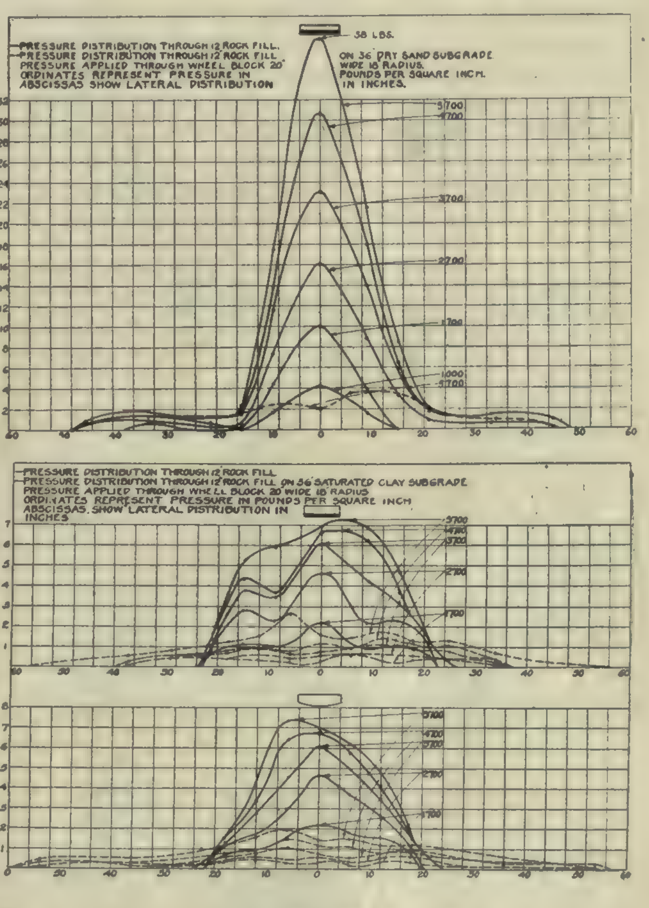


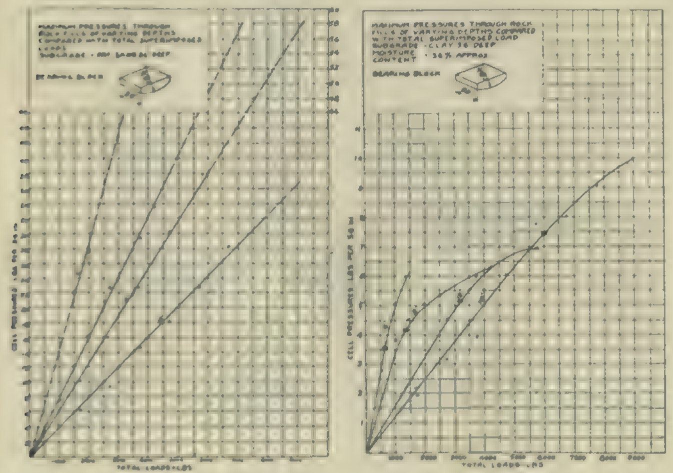
FIG. 3. TYPICAL PRESSURE DISTRIBUTION CURVES FOR DRY AND SATURATED SUBGRADES.

grade was placed in a bin about 10 ft. square to a depth of about 3 ft. compacted in as uniform a manner as possible. A number of devices for measuring soil pressures were then installed on top of the subgrade and the broken stone base was then compacted to the required depth on the subgrade.

A bearing block 20 in. wide and shaped to resemble a truck wheel was used in applying loads and the pressures on the subgrade were measured for different load applications. The curves of Fig. 2 are typical of the measurements obtained on the dry sand and on the wet clay subgrade. Note in the case of the dry sand subgrade very much higher intensities of pressures were obtained under the load than in the case of the wet clay subgrade. In other words, the sand offered higher resistance than the wet clay. During the application of the load, measurements of penetration of the bearing block were made in order to note the deformation of the base. It was found that the 4 in. base for the ½ in. penetration of the bearing block only withstood approximately 400 lb. as compared with 4500 lb. for the 18 in. base.

Fig. 4B shows the load carrying capacity of broken stone bases on very soft subgrades. These curves show the following points: (1) The maximum intensity of pressure on the subgrade decreases with the thickness of the base, at least until failure has begun. (2) In general, the thicker the base the higher the load carrying capacity. (3) The thicker the base apparently the higher can be the pressure intensity on the subgrade before failure takes place. The breaks in the curves as indicated by the rectangle shows the points of failure. Fig 4A shows typical results for a dry sand subgrade. Apparently no breaks in these curves occur showing so far as the loads were applied that the point of failure had not been reached.

The curves for the wet clay subgrade are particularly instructive in the light of results from the Bates Road sections built on a broken stone base. Here, under service tests, little difference in surface behavior was noted between the 4 in. and the 8 in. broken stone bases. The fact is that the allowable pressure intensity on the subgrade was exceeded even under the 8 in. base and such a subgrade would probably not have carried 8000 lb. wheel loads even with an 18 in. broken stone base when the subgrade was saturated. The subgrade used in the present investigations with 36 per cent moisture was probably somewhat harder than the Bates Road subgrade and the tests clearly show that on this subgrade an 18 in. broken stone base would suffer considerable deformation even under a 6000 lb. wheel load. These tests have not been completed and no other conclusions can be safely made at this time.



A

B

Fig. 4. Curves Showing Effect of Moisture Content Upon Bearing Pressures.

Impact Tests of Motor Trucks

During the past year no further work has been done to determine the impact produced by motor trucks on road surfaces under artificially imposed impact conditions. A large series of impact tests have been completed and as a result of these the following conclusions were drawn:

Fig. 5. Special Machine Developed at Arlington for Impact Testing.

1. Impact depends largely upon the kind and condition of the tire.
2. Thin or worn solid rubber tires, even though they be very wide, produce very high impact forces.
3. Pneumatic tires offer the greatest influence in reducing impact forces, and with their use the impact increases only very slightly with the speed of the truck.
4. Cushion tires, that is, tires having a degree of softness and deflection between solids and pneumatics, offer corresponding advantages in reducing impact.
5. Impact increases with the speed of the truck, but it can not be said to increase according to any constant ratio or power of the speed.
6. Although heavy unsprung weight may give higher impact than lighter unsprung weight, it can not be said that this is the major controlling factor.
7. The relative destructive effect produced by lightweight, high speed trucks and heavy, slow-moving trucks has not been determined by these tests. They do, however, indicate that equal impact may be obtained under some conditions.
8. Impact may be as high as 7 times the static load on one rear wheel when a solid-tired truck strikes a 1 in. obstruction at 16 mi. p. h., an average value being about 4 times. For pneumatic tires the maximum impact value is probably not more than 1¾ times the load at one rear wheel, and an average value is not more than 1¼ times the load.
9. All cushion wheels do not reduce impact on the road surface even though they may cushion the vehicle.

This series of impact tests will be continued with the use of motor vehicles operated on actual road surfaces and equipped with devices for directly measuring the impact under actual road conditions. Such devices will take the form of some type of accelerometer.

There have been constructed and tested at Arlington a large number of slabs of different design and there still remain a number of these slabs to be tested. These tests have all been described and it will be recalled that slabs were constructed 7 ft. square directly on the subgrade and were subjected to the impact of a special machine (See Fig. 5) consisting of a truck wheel attached to a motor truck spring which carries a load corresponding to the body load of the vehicle. A series of gears raise the rubber-tired truck wheel and allow it to fall repeatedly on the slab. Observations consist in stress measurements, deformation measurements and measurements of the actual force applied to the slab. Observations were also made of the load at failure. The preliminary results of these tests have already been published. Also, as a result of these tests tentative conclusions were drawn as to the thickness road slabs should have to withstand definite wheel loads.

It will be interesting to make a comparison of the results of these tests with those obtained from the recently completed service test of the Bates Road in Illinois. In comparing the Arlington impact slabs with the Bates Road test consideration must be given to the fact that the testing load used in the two cases was entirely different. In the Arlington test the breaking load was considered as a static load which was equivalent to an impact delivered by an impact machine in which the height of fall was the only variable. The breaking load on the Bates Road has been assumed to be the total load on one rear wheel. It is likely, however, that the actual forces to which the road sections were subjected by the motor trucks having constant wheel load were extremely variable, as indicated by an analysis of the breaks. It is probable, judging from a number of indications, that the breaks in the Bates Road occurred under force which may have varied as much as 100 per cent, making it impossible to make a very close comparison with the Arlington results. The general conclusions of the two tests, however, agree quite well. In both cases it was indicated that in general the resistance of monolithic brick slabs is equivalent to that of the two parts separately, rather than that of a monolith, that the bituminous filled brick add little if anything to the resistance of the concrete base, and also that macadam bases on a soft subgrade are soon distorted badly.

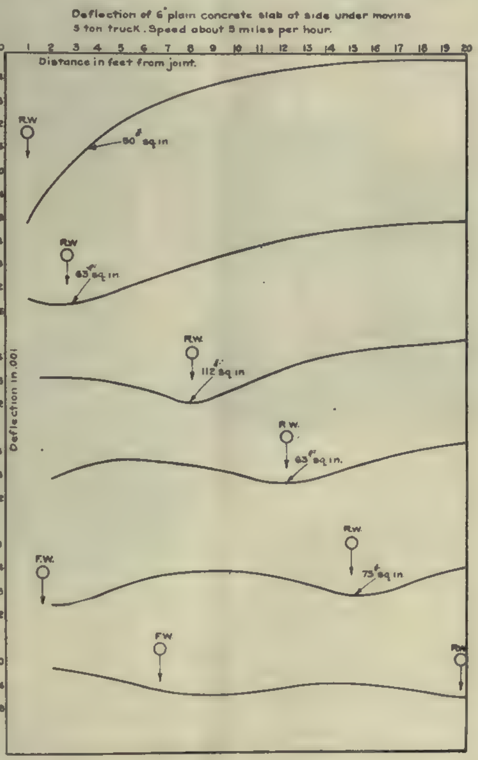


Fig. 6. Curves Showing Deflection of a 6-In. Concrete Slab Under a Moving Load of a 5-Ton Truck Moving at a Speed of 5 m.p.h.

In analyzing the Arlington results recourse was first had to the large series of Arlington impact tests conducted several years ago to determine how much impact was produced by motor trucks. It was assumed that it would be reasonable to expect motor trucks to deliver impact to a road surface due to a ¼ in. height of fall and that 30 per cent could be added to this impact due to tires in poor condition. In this manner the impact to be expected from motor trucks of different size upon an average road surface was predicted. The actual impact under which the various slabs at Arlington broke was measured and could, therefore, be expressed in terms of the wheel load of the motor truck producing that same impact. It is anticipated that the coming series of impact tests at Arlington will throw considerable light on the effect of the subgrade on the load carrying capacity of the slab.

There was completed during the winter of 1921 an experimental concrete road constructed in Arlington County, Virginia, and known as the Columbia Pike. This road contains thirty-two sections of varying design. These sections involved inverted curbs, both at the sides and in the center of the slab. They also involved a center longitudinal joint, a large percentage of longitudinal steel and also slabs constructed on a sub-base of cinders. Except to call attention to this experiment the details cannot be mentioned at this time. There should be mentioned, however, a series of tests which have just been begun on this experimental stretch, in order to bring forth what seems to be a most important method for investigating the safety and investigating the correctness of design of concrete raods and for determining whether they are over stressed.

For the purpose of this investigation a new type of graphic attain gage has very recently been devised and it is of such small dimensions that it can be set in a recess formed in the surface of the road. A number of these devices can be placed in different positions in the slab and the slab may then be subjected to heavy motor truck traffic running directly over the instruments which are protected by means of a thin cover plate. After the passage of the truck the graphic record which has been made on a smoked glass plate attached to the instrument is removed, coated with a film varnish, filed away and later measured under a microscope. In this manner

Fig. 6 shows the shape of the elastic curve of the slab obtained by a special deformation apparatus. It will be noted that in this test the maximum tension occurred at the bottom of the slab directly under the load. This is indicated not only by the strain gage measurements but by the radius of curvature of the elastic curve. In other words, maximum tension does not always occur at the corner of the slab; in fact, it may occur directly under the wheel load. It should be emphasized again that this offers a most important means for investigating stresses produced in concrete road slabs under moving loads. If any state highway department wished to actually find out whether or not its legal limit of loading is producing stresses in its concrete roads in excess of a safe working stress this could very readily be done in the course of a very few hours.

The foregoing in a general way has touched on the more important investigations which have shown results. Before closing I should like to refer to some of the new and more important investigations which have recently been started.

New Investigations Now Under Way at Arlington

Perhaps one of the most prominent defects of the bituminous type of surfacing is its tendency toward waving. This is not necessarily fatal to the integrity of the surface but in its most exaggerated form it is decidedly unpleasant to traffic and no doubt the roughness produced is likely to result in low economy in motor vehicle operation. Certainly it would be worth while if this form of defect in the bituminous surfacing could be overcome, and with this purpose in view a circular track 190 ft. in diameter and 13 ft. wide has been laid at the Arlington Experiment Station and is now being subjected to motor truck traffic. The truck is constructed on a 6 in. compacted gravel sub-base, upon which a 6 in. 1:1½:3 reinforced concrete base is laid, the surface of which was troweled in as uniform a manner as possible and finished with a greater degree of smoothness than is the ordinary concrete base.

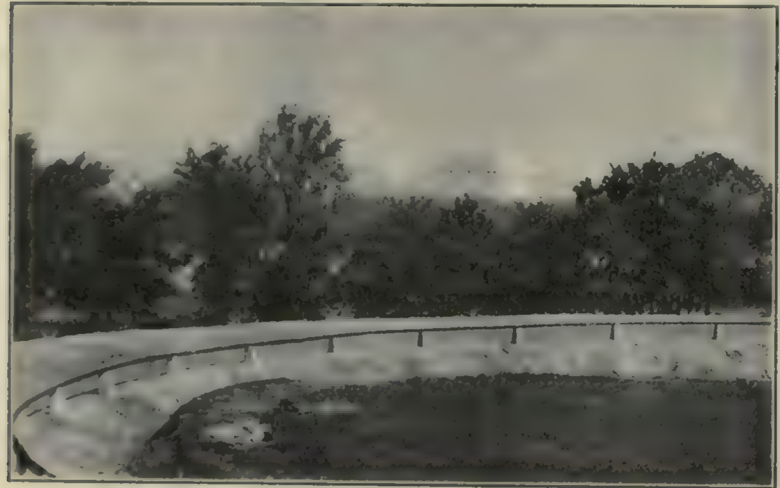


FIG. 7. A GENERAL VIEW OF THE TESTING FIELD AT ARLINGTON.

There are 27 sections of bituminous concrete laid on this concrete base. All of the sections are of the coarse-graded type and the variables consist in changes in the percentage of asphalt, penetration of asphalt and grading of the aggregate. All of the sections were covered with a light squeegee coat, which in turn was covered with trap rock screenings. All of the bituminous concrete used is likewise being subjected to laboratory tests, with special tests which have been developed for the purpose of studying the properties of bituminous concrete mixtures. A general view of the track is shown in Fig. 7.

In each section two radial lines of brass plugs have been driven at the third points. The plugs are spaced about 1 ft. apart. In addition to these plugs other plugs have been placed, made up of segments extending from the top to the bottom of the surfacing. If shoving takes place under traffic the location of these plugs when referred to definite base lines will show the extent of the shoving and the segmental plugs will indicate something of the motion of the top layers with respect to the bottom layers. A profile recording machine is used to record the profile of the surface at various stages of the test. In the initial test a 3-ton truck is being used and is so guided that the rear wheels cover a path 2½ ft. in width. It is planned to use th eremaining untraveled paths in a subsequent test. Thus far, practically no shoving action has been noted on any of the sections but all of the traffic has been run in cold weather.

A Study of the Concrete Road Making Properties of Various Kinds of Aggregates

It is thought by many engineers that at present many suitable aggregates are being ruled from use on concrete road construction because they are believed to be too soft. Many engineers are of the opinion than even comparatively soft aggregate will build durable concrete roads, especially in view of the almost entire absence of steel-tired traffic. If comparatively soft local materials are suitable the question arises: Just how soft can an aggregate be for satisfactory road construction. It was for the purpose of studying this question that aggregates were collected from various sections of the country varying from the very soft material to very hard and tough aggregate. In a circular track built just outside of the bituminous track above described there have been built 62 different sections of concrete.

In addition to a study of coarse aggregate, a number of other studies are being made with the use of the track. The following groups of sections will give an idea of the problem involved:

Group 1. Quality of crushed stone as a coarse aggregate.

Group 2. Quality of gravel as a coarse aggregate.

Group 3. Quality of sand as a fine aggregate.

Group 4. Effect of consistency at time of mix and proportioning.

Group 5. Quality of slag as coarse and fine aggregate.

Group 6. Quality of Miscellaneous aggregates.

Group 7. Effect of tolerance material, one size stone one size sand, screenings, mortar topping, and hydrated lime.

The concrete track for the preceding studies is 4 ft. wide and it carries a narrow gage railway track. A specially constructed electically driven truck serves as the wearing device. It consists primarily of two motor truck wheels having rubber tires, the rear wheel driving the truck and the front wheel being driven. These wheels are weighted with a load producing any desired weight per inch width of tire. The rubber tired wheels are steered by means of an auxiliary truck mounted on a narrow gage track. Two of these devices coupled together are driven electrically at a speed of 22 m. p. h The rubber-tired wheels run in exactly the same track so that an accelerated effect is obtained. Careful measurements are made periodically on the amount of wear produced and in time the undesirable sections will be indicated. Auxiliary tests, of course, have been made on the concrete used, including compression, transverse and "Talbot Jones" rattler tests.

Skew Arch Bridge Test

One of the functions of the Testing Division of the Bureau of Public Roads is to study bridge problems and at the present time there is under way a series of tests on a small sized skew arch (See Fig. 8) for the purpose of determining principally the distribution of abutment pressures.

In this investigation the arch is loaded with a uniform load by means of a number of calibrated springs equally spaced on the extrados. Strain gage measurements are taken during the application of the load and, in addition, the abutment reactions are weighed at the four corners and at the ends and sides to obtain all components of the abutment pressures. These pressure measurements are accomplished without motion of the weighing device, which depends in principle upon the elastic deformation of a hard steel spherical surface in contact with a hard steel flat surface. The flat surface is coated with lamp black and the circular impression made on the lamp black is entirely dependent upon the load applied. It is too early to announce any results from this investigation until more have been accumulated.

In so brief a paper it has been impossible to do more than touch on the character and results obtained from the most important investigations under way at Arlington. I might mention that we have a number of other research projects connected with the design of roads or highway bridges in various stages of completion. All told, the Division of Tests of the Bureau of Public Roads is alone engaged on some forty researches. In addition to these it is cooperating with a number of institutions on other researches in highway engineering. It might be thought that so extensive a program involves the expenditure of a considerable amount of money, and it does, but when it is considered that millions of dollars are yearly spent for highway construction and that information obtained by research leads to more definite knowledge of the basic principles of design, it is realized that the funds expended for research will be saved many times over through decreased maintenance and prolonged life of the road through better road design or through determination of the safe legal load limit.

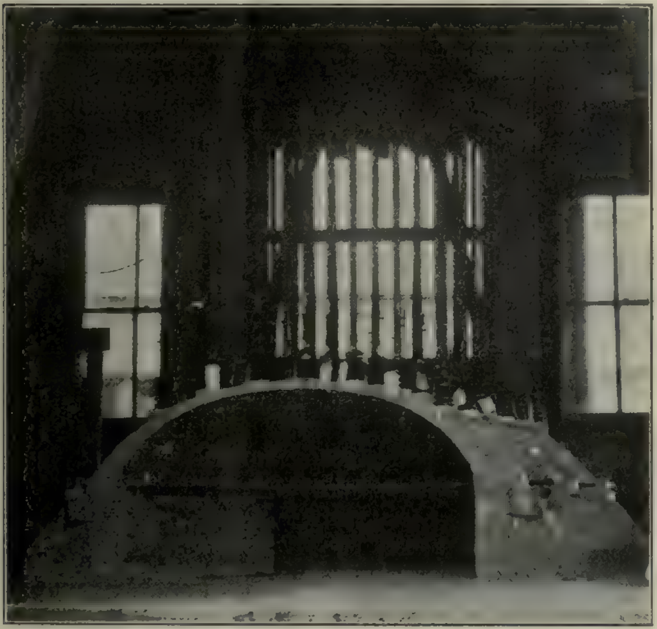


FIG. 8. SKEW ARCH BRIDGE UNDER TEST BY THE BUREAU OF PUBLIC ROADS.

Concrete as a Bridge Building Material

WRITING in "The Surveyor" W. Marriott says he was first attracted to the use of concrete as a bridge building material through reading Monier's experiments in Austria more than forty years ago; in fact, many years ago when he commenced his railway career he was with a firm that had done a good deal of foreign work and who were among the first exponents of concrete in this country. We endured a great deal of opprobrium, and our concrete was not up to modern standards, or to present-day knowledge, but as the proof of the pudding is in the eating, he is able to say that bridges built then have stood, and are standing today, in as sound or sounder condition than they were on the day they were constructed. There are not many engineers who can say they have bridges in concrete nearly fifty years old on which not a penny has been spent on maintenance. In those days there was no steel in the concrete as reinforcement, as we now understand it, as the floor systems are generally formed by rolled iron joists which took all the weight, and were imbedded in concrete mainly for protection.

The only difficulty we have had with concrete has been that when we have had to pull down buildings, etc., for enlargement, so solid and sound were the structures they were very difficult to remove, and the fact has also been noticed that the joists where they have been covered or embedded in concrete were as good as the day they were put in, and in many cases had even got the mill bloom still on them.

Since those days, whenever permissible, the writer has built scores of bridges of concrete, using, however, a brick facing as being cheaper than shuttering, and even going so far as to build in lime concrete with excellent results, as was proved when one of these bridges near Cromer had to be taken down recently, the lias lime being hard as a rock.

The use of pre-cast reinforced concrete in bridge work also offers many opportunities for economical construction. It is quite possible, and the writer has done so, to make concrete girders for short spans complete and ready to lift into place. In other cases, where the steel girders are encased in concrete, the floor system is economically made of arch blocks.

These arch blocks are pre-cast, and can be run into place as fast as men can handle them. They are then covered up with concrete in situ, and trains can be, and have been, run over within twenty-four hours. They form a bridge floor which is economical in first cost, and also in maintenance, especially where trains are continually running underneath, no temporary woodwork or centering is required, a good coat of lime white every now and then being all that is necessary.

There are many ways of designing bridge floors. Some engineers prefer a flat slab. The writer considers that the arch is more scientific and economical. To give details of various possible methods of treatment would make this paper too lengthy, suffice it to state what is being done.

He reinforced his first foundation about 1884, nearly forty years ago, having some bridges to build on very bad ground, and it was necessary to make a kind of raft. Some sixteen years ago he came to the conclusion that if concrete was to come to the fore weight must be reduced, and the articles must be scientifically designed.

The writer was led to this largely by seeing an exhibition of concrete articles which were so heavy and enormous as not only to be wasteful in material, but costly to handle. He then formed the opinion that all articles where possible should be hollow, or be cored out in some way so as to reduce all surplus material, and made much as cast-iron is in moulds by casting. So many had gone on the lines of simply reproducing in concrete the wooden article they were replacing, forgetting the adage that "Grandfather made his fortune because he made an old thing in a new way, or a new thing in a old way, or a new thing in a new way, never the old thing in the old way, always the factor of novelty was one of the terms of his formula of success."

Sending the Highways to School

By GEORGE M. GRAHAM

Vice-President, Chandler Motor Car Company, and Member, Highways Committee, National Automobile Chamber of Commerce.

PERHAPS to some people the designation "highwaymen" once seemed appropriate, at least in as far as it related to a portion of us. The taxpayer assessed for his share of a mile of concrete road, or the motorist settling his automobile repair bill, may often have felt that highways transport and "hold-up" went together. Happily, better methods and a better understanding are changing this condition. We have this great advantage over Robin Hood, Jack Cade and Jesse James, that robbery is not essential to our program. The knights of the road used to pretend that they robbed the rich to help the poor, quite overlooking the incidental benefit to themselves. In our work without discriminating against anyone we can benefit all. The application of the ordered processes of education to highway transport problems is of infinite importance. It means almost incredibly expanded possibilities.

Nothing Education Cannot Conquer

The solution of every problem depends on education. In fact, it comes as near omnipotence as can anything human. Nothing is beyond the compass of education. It deals in miracles. It can make of the ignorant immigrant a successful business man in two years, it can develop into contact with the world the blind, deaf mute, Helen Keller. The subject of how our educational institutions may aid the course of highway transport is so big that I have need to be careful lest this presentation be encumbered with excessive detail. I shall try to concentrate on those factors which are regarded by our industry as fundamental. You have a right to be answered on certain elemental questions before we can reasonably expect to enlist your co-operation. Is there a future for highway transport? Will it offer an honorable, useful and remunerative calling to those who adopt it? Are we in time, or has the subject been already over-exploited?

It seems to me that the right answer can be made in a few words. None will deny that food, fuel, raw material, finished product and facile passenger communication are highly necessary, and that whatever brings them to the people at lowest cost constitutes public service. If this be conceded the case of highway transport is established. I doubt not that there will be ample rewards for trained men who can develop the highways so that they may take their proper share of distribution. Far from being over-exploited, highways transport is still an infant industry. In fact, all transportation is a young science.

Go to the authorities and try to study the history of transportation, and you will be amazed to find that until the last one hundred and twenty years there is no advance. The Romans, and later the French, under Napoleon, built some good roads, and that represents the sum total of progress until the first decade of the nineteenth century. It is hard to realize that anything so vital to human kind as transportation should have been so slow in its development. The man of Nazareth, founder of the faith, and George Washington, founder of his country, living 1800 years apart, knew only the same mediums of transportation. On land they could be hauled by man or beast. On the water they were dependent upon the straining muscles of the oarsman or the vagaries of the wind. It is an amazing thought when set against all that happened in the world in that time. The culture of Greece, the far-flung power of Rome, the mighty empire of Charlemagne all had their rise, their history and their fall. The Dark Ages and the Middle Ages came and went. The Crusades wrote their dramatic history. In the fifteenth and sixteenth centuries came that great outburst of exploration that carried the mariners of Europe all over the world to the discovery of new counties. Three great revolutions, in England in 1688, in our country in 1776, and in France in 1793, made their contributions to free institutions. Yet during all that long period, transportation stood still.

Education is urgently needed to give highways transport an efficiency that previously it has lacked. Up to date we have, to a large extent, simply blundered along. I doubt not that there have been made automobiles that did not fit the highways, and highways that did not fit the automobile. There have been iniquities of taxation. There have been faulty choices of routes. There have been many economic mistakes, based mainly on the fact that the science is so young and the elements so huge. I believe that education is ready for this immense task, because its great modern keynote is practicality.

Transport is Vital to All Sections

In days gone by, and particularly in the older countries, it was the function of college training to make what were smugly called "gentlemen." The student of then bothered little about the accumulation of education. Diversion was more important. He sought a roystering four years, with some such occasional prank as smashing windows, burning a barn or dropping a policeman down a sewer. But the intensity of modern competition has changed all this. The student cannot afford to waste his time, and the colleges, therefore, may live up to their high ideals of service to the public, demonstrated in turning out yearly useful and efficient specialists.

Perhaps the greatest boon of transportation is not a technical one. It does not have to do with subgrades or road surfaces, with automobile horsepower or with taxation schedules. It concerns rather the lowering of the costs of the necessities and enjoyments of life so that happiness may be widespread. This has an importance that carries it into the realm of economics and statesmanship. It is the reply to the malcontent or Bolshevist who raises his voice against our institutions.

In directing his attention to highways transport, the educator does not limit his scope. He has a subject which is just as vital to the cities as to the rural section. First consider the farmer. Here is what the combination of motor car and good roads means to him: It gives access to the nearby town and thus ends his isolation. It brings the school nearer to his children. It shortens the distance from the doctor's office. It is the connecting link between his farm and his market. It carries

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Abstract of an address delivered at the Second National Conference on Education for Highway and Highway Transport Engineering, held under the auspices of the Highway Education Board at Washington, D. C., October 26-28, 1922.

his newspaper and magazines. It delivers supplies of all kinds to his kitchen door. It gives him more time to work on the farm. It enables him to buy land for its productiveness and low cost uninfluenced by contiguity to railroads. He can move his produce when prices are right, and develop not only a broader market but a more stabilized one. Equally decisive is the advantage to the city worker of moderate means. His car permits himself and his family to escape urban squalor and congestion for the health and beauty of suburbs. It is available to himself and his family for a hundred valuable services.

The motor vehicle actually gives this country some 11,000,000 transportation monopolies, all, whether truck or passenger car, subject to schedules and routes made by the owner. This means individual transportation. I have spoken of "individual transportation." I should like to analyze that term, and undertake to show you gentlemen a most interesting reversion of method. Generally speaking, our modern development has been from individualism to centralization. Our country began as an association of individual states, but their boundary lines constantly become less important and the Federal idea more dominant.

Tendency Toward Centralization

Formerly the workman's productiveness depended upon his possession of the tools of his craft. The carpenter with his saw, the shoemaker with his awl, the blacksmith with his hammer, the printer with his stick, each carried his trade with him wherever he went. That was individualism. Then came a great modern development. Huge machines supplanted the tool. They enormously increased production.

For centuries individualism dominated transportation. The horse and wagon, the man and boat, are instances. Then great steamships, steam railways and electric trolleys took transportation from the individual. This was combination, it improved service, and these great mediums will always be with us in a place of commanding importance. But transportation has lately presented the paradox of a return to individual facilities. In both freight haulage and passenger transportation, the motor vehicle has turned back the hands on the clock of time, and we now supplement centralized transportation with an individual medium, subject entirely to your own whim, preference or need.

Essentially highways transportation need not conflict with other kinds of distribution. It cannot haul the two and one-half billion tons of freight carried by the railroads in a normal year, nor transport such part of their billion passengers as ride long distances. It cannot give service in congested municipal areas to the sixteen billion yearly electric trolley passengers. But it can serve the public over two and three-quarter million miles of highways, the greater portion of them not cared for by any other transportation element. I have discussed general considerations, have analyzed the present status of highways transport, and have briefly indicated some of its possibilities.

I should like now to be more concrete and to make recommendations concerning the subjects to which educators should give thought in arranging their courses. The subject is so big that it involves a whole new system of education. I genuinely believe that the various branches of highway transport cover a wide enough range to furnish the exclusive subjects of training for a very considerable college. Without attempting to subdivide the work or to deal with its minor phases, there seem to me six main types of men you must produce. The following is the list:

1.—Road builders.
2.—Motor car producers.
3.—Highway financiers.
4.—Highway lawmakers.
5.—Transportation analysts.
6.—Real estate experts.

Perhaps the biggest task of all falls to the road builder. In this class I naturally include the highway commissioner, the highway engineer, purveyors of materials and the contractors who actually do the work. To this group is allotted the major responsibility of building roads of sufficient carrying capacity to take whatever traffic be demanded by the nation's economic needs. These roads must not only join present populous points but must open new territory.

Along with the roads there must be provided adequate maintenance at not excessive cost. It has been pointed out by the field marshal of good roads, Chief McDonald, that our greatest problem is to see that our highways keep pace with increasing highways rolling stock. There has been three times as much investment in rolling stock between 1910 and 1921 as has been expended in the same period for highways construction. It is an enormous responsibility to plan an adequate highway system for a country covering three million square miles. Six hundred million dollars were expended last year by Federal, State, County and Township divisions upon highway construction and maintenance. In the program is involved the biggest expenditure ever assumed by this country except for war projects. Its total dwarfs the cost of the Panama Canal. There are questions of proper routes, studies of subgrade and proper surfacing. The men who will assume this responsibility cannot be too efficient, cannot be too highly trained.

Motor Car Producers

Secondly, we must have the automobile builders. We are far from believing that our industry has yet reached its ultimate. It is true that we have already attained to extraordinary figures. Our trucks move a billion and a quarter tons of freight a year. Allowing for ten million passenger cars in daily use, on the basis of 2½ persons riding in a car, we have twenty-five million automobile passengers daily. But these figures, though wonderful, are not the ones of which we are most proud. Still more do we felicitate ourselves that the genius of quantity production has permitted such a widespread distribution of our product. Seventy-two per cent of all the automobiles go into population points of 50,000 or less, 52 per cent into points of 10,000 or less, and 30 per cent into points of 5,000 or less.

But we still have other things to accomplish. We want to build automobiles and motor trucks that will adequately serve the public in transportation of persons and commodity, but inflict upon the highways a minimum of damage. We constantly aim to lower the price of our units so we may have more users. We seek to get lighter weight without sacrifice of stability, riding comfort or safety. Perhaps the engineer to solve these problems is now a student in one of your colleges. He will be well rewarded, for the industry deals in big elements and can afford to pay.

Need Experts in Finance

The third requirement is that our colleges should develop intelligent specialists on highway finance. The greatest deterring factor to more and better roads is the question of paying the bill. There will be acclaim for the expert who can determine the proper basis of automobile taxation and the equitable allotment of highway construction costs.

Let me show you one or two of the problems. An excellent instance is to be found in revenue laws, which put the heavier tax on what were termed "luxuries." Among other items Congress taxed long ditance telephone calls, amusements, phonographs, moving pictures, automobiles and automobile repair parts. None of these taxes were aimed at the farmer, yet he it was who suffered most, for all these items are vital to make tolerable his life on the farm. The telephone ends his isolation. The phonograph makes it possible to bring the master works of music to his home and children. The moving picture is one of his sources of education and diversion. The automobile is the basis of his contact with the outside world and his medium of transportation. As owner of one-third of the automobiles in the United States, he suffered more through the parts taxes than any other one class. Do not forget that when the farmer's automobile drops into a chuck-hole and breaks an axle, it is tough news for himself, and his family. Even his neighbors regret it. But the United States Government is no "good Samaritan," for back of the barn lurks the tax collector waiting for his 5 per cent on the replacement axle.

Experts in Highway Finance Needed

Perplexing problems are involved in the financing of highways programs. We believe that two classes of our people should pay for building and maintaining our highways. First: Those who own motor cars. Second: Those who do not. This is another way of saying that since everybody benefits everybody should pay, the major part of the cost naturally going to those who benefit most. As a fundamental we advocate that taxation shall come under one jurisdiction and should be uniform in type, if not in extent. All funds levied from the automotive industry should be applied to the highways since those who pay such levies are also bearing the other taxes common to all citizenship. Forty per cent of the cost of construction of the higher type of highways is permanent in character, as for example: drainage, location gradients. Therefore, it seems unreasonable to ask the people of the present decade to meet the entire cost of such construction. Therefore, as general principles we contend:

(1) That all highway expenditures should be divided just as railroad expenditures are, into two classes, capital outlay and current expenses.

(2) Since capital outlay is a permanent investment it should be paid for from the proceeds of long term bonds, and since highway construction is of benefit to all, the interest amortization charges for such bonds should be paid for from general taxation.

(3) Current operating expenses naturally include all the costs of keeping these highways in first class condition. Everybody should pay some part of this maintenance cost through a general system of taxation, but the higher assessments for maintaining the highways should be borne by motor vehicle users and by agricultural and urban property owners whose valuations are enhanced by highway improvements. The proper ratios can be ascertained only by detailed study.

Just in this casual glance at the problems of finance that stand in the way of highway expansion, I think I demonstrate the need of men trained in revenue questions.

Highway Lawmakers

Our fourth great necessity calls for legal specialists. The college that will turn out authorities on the subject of highways and automobile legislation, will confer an immense boon to the country. At the present time the legislatures of forty-eight states are working on varied highway enactments. Some of the provisions are wise. Some of them are unwise, despite sincere and painstaking efforts to get right results. In most cases the failures result from the lack of adequate data. Theer are lots of subjects to which the expert highways legislation can direct his attention, even after the question of finance has been eliminated. Legislators can render a great service in working out uniform regulations of motor transportation. A centralized control, preferably by each state, will remove many local evils, and hasten progress. State enactments should as quickly as possible be brought into accord with each other and with Federal enactments

The proper regulation of the increasing volume of city traffic daily becomes more difficult. Our industry cannot register too strongly its opposition to overspeeding and overloading. It will welcome any program that will safeguard pedestrians, particularly children. At the same time, the motor vehicle as a medium of great public service must be reasonably protected in its rights.

There is also the great issue of the regulation of motor vehicles as common carriers so that they and other mediums of transportation may not suffer unfair competition. Assuming that this becomes inevitable it should be friendly to highway transport and not punitive. It should protect the rights of road users and prevent abuses. The expert on highway enactments will find plenty of call for his services.

Transportation Experts

There must also be trained transportation experts who can tell where traffic should properly be allocated. This is the fifth kind of a specialist you can develop. These men can find clients in all lines of activity. They will make investigations and advise great manufacturers and merchants where and when they should use railroads, steamships and motor trucks. They can also be of help to the farmer in advising him as to the best means of reaching his market, having in mind all question of perishable product, seasonable demand and cost of delivery. Transportation is so large a factor in the cost of products that it is not difficult to estimate the service that trained experts could render. Somewhat related will be the traffic expert who will assist in city planning.

The real estate man is intimately concerned, perhaps more so than he knows, in the results of the new relationship between the highway and the motor car. He forms the sixth essential kind of highly developed expert. Those who think of the automobile merely as a "pleasure car" have perhaps never contemplated what a terrific real estate upheaval there would be if the car and truck should suddently be withdrawn.

It will be found by analysis of living condition in any great city that its central portion is more and more given over to commerce and manufacturing, and that the residence section constantly moves further into the suburbs. The man of wealth and the man of only modest means find that the automobile gives ready touch with the heart of the city. They ever have at hand a medium of individual transportation. Therefore, the automobile and the motor truck actually constitute a kind of real estate insurance. There must be studies of how real estate values are increased by contiguity to improved highways. This is destined to be one of the big subjects of the future.

I have endeavored to suggest the kind of men we need for this work. Those who enter it will find forceful cooperation from the government, for through the splendid efforts of the War Department, the Bureau of Public Roads and the Highway Education Board, Washington has powerfully testified its interest. This is important for the subject looms big with respect to our national future. In forwarding highways development, the educator gives new force to an ancient alliance. Sentimentally and historically the highway has great claims upon him. Since colonial days the destinies of highway and education have been linked. When the settler had blazed his trail through the forest, he built the rude schoolhouse. Ignorance has had no more relentless foe than this combination. The humblest road leads finally to the schoolhouse. Now the schoolhouse is outstripping its college. Much road mileage remains primitive but the homes of education have undergone a transformation. The little wooden shack has become the great stone palace of study.

Worthy structures have multiplied in all sections of the land. The smallest county boasts its fine High School. If there be but one worthy edifice in a community it is usually dedicated to education. For the good of us all the highway must not be permitted to lag. It must keep pace with the school, so that the union of the two, both freed of politics and both intelligently administered, may render its priceless service to the nation. There could be no higher aspiration, no more dignified career, no better citizenship, no more practical patriotism, than to strive for this result.

Road Building in the Hawaiian Islands

By WALTER WILSON CROSBY

THE wettest spot in the world, despite the 18th Amendment and the Volstead Act is in the United States of America. The maximum annual rainfall in the Hawaiian Islands is 660 in.; the minimum is less than 20 in. per annum, and between these two extremes the engineers of the Islands have to plan such measures and devise such schemes as will enable roads to be built and maintained economically, bridges to be provided efficiently, and water supply, sewerage, and such construction to be safely done.

A recent visit—which if short was comprehensive—to Honolulu and Hilo impressed the writer with the difficulties under which road work in the Islands is carried on and with the good condition of the roads notwithstanding these difficulties. The main roads seem to be largely bituminized now and to be well planned to meet the needs and the rough topographical conditions. They furnish excellent surfaces and generally sufficient width for the traffic on them beside wonderful scenic opportunities for the travellers. Much yet remains to be done to complete the systems desirable for the proper development of the various islands to satisfy even present needs but it appears that progress is rapidly being made by the authorities in most cases.

On Oahu (where the city of Honolulu is located) the engineer (Frederick Ohrt) is in charge of both the street work in the city and the road work in the County of Oahu. (Each island is a separate county.) His results appear excellent and the work in progress seems to be planned for a maximum of economy and efficiency. The character of his work varies from cement-concrete surfacings, where clay or "adobe" roadbeds are inevitable, to bituminous macadam or even bituminous surface-treatments on old water-bound macadam where conditions permit the less expensive methods, and includes some excellent bituminous-concrete on cement-concrete base within the city limits. A particularly gratifying feature noted in his work was the widening—with penetration macadam—of some of the old and now too narrow roadways under rather intense motor traffic.

On the island of Hawaii, where the city of Hilo is situated, some excellent modern road and street work has been done. The too-frequent tendency toward adopting an excessively expensive type of surfacing for all situations is somewhat evident, though Mr. Ohrt seems to have resisted it successfully and rather unusually, for which he deserves his commendations.

Through Hawaii National Park, surrounding the famous active crater of Kilauea, Superintendent Thos. H. Boles has done excellent work with the small funds at his disposal for road-work. The travel on these Park roads is of course light and entirely of pleasure motor-vehicles. The subgrade is lava and so pervious to water, either by its inherent porosity or by the prevalence of fissures, as to readily take care of the heavy rainfalls (26 in. in January alone), and permit the successful construction and maintenance of a thin and inexpensive form of road-crust. A bituminous surface treatment will efficiently support the travel and permit the maintenance of the roadway under the severe washing tendencies of the rains.

KING STREET, HONOLULU, FEDERAL BUILDING ON LEFT.
Surfacing, Two Inches of Asphaltic Concrete (Coarse Aggregate Mixture) on 6-In. Cement-Concrete (1-3-6) Base. Built in 1921-2. Standard City Construction.

Aside from the road work, interesting engineering problems in the Islands accompany the provision of irrigation water in the drier sections behind the mountains where the soil is suitable for the cultivation of pineapples and sugar-cane but the precipitation is naturally insufficient.

(*Continued on Page* 175)

What is the Cost of County Road Construction?

In Norfolk County, Ont., 8¾ Miles of 18 ft. Tar Macadam Penetration Road, Cost $199,647—8 Miles of Gravel Road, 14 ft. Wide, Cost $69,860

By G. R. MARSTON
County Engineer, Norfolk County, Ontario

PEOPLE are inclined to criticise the expenditures which are made for road purposes, but if they will notice the expenditures for travel it might be different. The increase in automobiles between January, 1918, and December, 1922, in the Province of Ontario is 131,533 passenger cars and 19,235 commercial cars, or expressed in dollars an expenditure of abour $100,000,000. Taking the total number of cars in Ontario, including passenger and commercial cars, we have a grand total of 234,172, and taking 2,000 miles as an average mileage per car per year, we find that the cars of Ontario travelled 468,344,000 miles in 1922. A conservative estimate of cost for travel including gasoline, oil, tires and repairs has been placed at 10 cents per mile, and we deduce from that that in 1922 the owners of cars paid $46,834,400.00, a sum equal to twice the expenditure made in construction and maintenance of roads in the Province of Ontario dur-the same year.

There are at least four essential points to be considered in the construction of county road systems.

1. The adoption of a system of County Roads under the Highway Improvement Act.
2. A definite plan laying out the order of constructing the roads of the said System.
3. Types of road to be constructed.
4. Financing.

The County of Norfolk assumed a system of county roads under the Highway Improvement Act in the year 1917, attaching a rider to the By-Law that no road construction work be commenced during the war period. In 1919 a definite plan for the order in which the roads should be built was adopted. In the policy adopted by the county council the types of construction decided upon were tar macadam penetration for the provincial county roads and other main travelled highways, and gravel construction for those of lesser importance, the provincial county roads to be graded 28 ft. wide with 18 ft. of metal and the county roads to be graded 24 ft. wide with metaling not less than 14 ft. width. To date there has been constructed 8¾ miles of tar macadam penetration, 18 ft. wide; 3 miles of tar macadam, 14 ft. wide; 4 miles of macadam base, 14 ft. wide and 8 miles of gravel road construction, 14 ft. wide.

In the construction of the tar macadam roads it was desired to get a 10 in. depth of completed road, but in many instances the thickness is greater owing to the subsoil being unstaple; consequently a greater amount of stone was used in the foundation.

The following figures relate to the construction of a provincial county road, width of metal being 18 ft.:—

Total length of road	8¾ miles
Total length of road	92,400
The cost is divided as follows:—	
Grading	$ 4,500.42
Tile draining	25.35
Culverts	1,628.28
Material (Stone 44,096 tons.) (Tar 192,000 gal.)	136,784.13
Hauling	29,587.51
Levelling	5,379.96
Rolling	7,856.30
Heating Tarvia	1,843.83
Unloading Stone	10,372.39
Guard Rails	69.00
Total Cost	$199,647.17
Cost per mile	$ 22,816.82
Cost per square yard	$ 2.16

It must be remembered, however, that while the cost of this 8¾ miles is $199,647.17 only 40 per cent is chargeable to the county. This may be more clearly shown in the following schedule:—

Total cost	$199,647.17
Amount paid by Province	119,788.30
Actual cost to County	79,858.87
Cost per mile	22,816.82
Amount paid by Province	13,690.09
Actual cost to County	9,126.73
Total cost per square yard	2.16
Amount paid by Province	1.276
Actual cost to County per square yard	.864

While the above analysis gives the actual data as far as the province and county are concerned it does not convey any idea what this cost may mean to an individual rate payer. Taking the actual cost per mile to the county at $9,126.73 and bearing in mind taht the equalized assessment is $14,230,444 the cost per mile per $1,000.00 assessment is 64 7-10 cents. In other words a rate payer having an assessment of $1,000 has been called upon to contribute $5.66 towards the construction of this 8¾ miles.

In the construction of the gravel road the same precautions were taken in grading and drainage as in the construction of the Tar Macadam road. It was aimed to get a consolidated roadbed of 12 in. of gravel, excepting in places where the bad sub-soil was encountered and then extra gravel was used. A crushing outfit with bin was purchased and all gravel was crushed; the gravel was laid in two courses and rolled until compacted. The total cost of the 8 miles is $69,860.59 which is divided as follows:—

Grading	$10,459.58
Culverts	8,194.53
Tilt draining	2,915.64
Material (Gravel 29,575 yd.)	1,734.85
Hauling	23,855.68
Levelling	2,369.71
Rolling	3,621.26
Crushing	15,516.77
Shovelling	1,192.57
Total Cost	$69,860.59
Cost per mile	$ 8,732.57
Cost per square yard	$ 1.06

Of this cost the province pays 40 per cent and without going into details this road has cost the rate payer 36 8/10 cents per mile per 01,000 assessment.

Abstract of a paper presented before the Ontario Good Roads Association.

Progress in Cement Research

IN a review of the work undertaken at the Structural Materials Research Laboratory, of the Lewis Institute, Chicago, by the Portland Cement Association, under Prof. Duff A. Abrams, covering the period April 1 to October 31, 1922, a summary of investigations completed or under way is given, showing the valuable work which is being done by this organization. Research work is gradually being expanded to such a way as to furnish direct information on many problems which are encountered in the daily uses of cement and concrete. The equipment of the laboratory now compares favorably with the best in the country; however, as the research work expands, additions to equipment are necessary in order to enable investigations to be carried out of importance to the industry.

Investigations of concrete exposed to alkali soils and waters have been continued in various parts of the United States and Western Canada. The tests include studies of the effect of the following factors.

Consistency of concrete, size of aggregate, grading of aggregate, type of aggregate, quantity of cement, composition of cement, powdered admixtures, integral water, and alkali-proofing compounds, surface coatings, age and curing condition of concrete, comparison of results of field and laboratory tests.

These specimens were placed in probably the most severe exposures found in the entire country and that the specimens which have been attacked are in general the ones that would be expected to fail. About 6000 4 by 8-in. cylinders were made parallel to the field specimens described above and stored in various solutions in tanks in the yard near the Laboratory. The solutions have been renewed at frequent intervals and the specimens examined.

Special samples of cement were prepared with which 0, 10, 20, 30, 40 and 50 per cent of high calcium and high magnesium granulated slag were ground. Concrete and mortar specimens were made for strength tests at periods up to 3 years. These cements were also used in a portion of our tests of concrete exposed to alkali.

Cement, mortar and concrete tests are being carried out on 12 brands of portland cement selected from dealers' waerhouses to different sections of the country as widely separated as the Hudson River and Kansas City. The purpose of the tests is to learn what variation may be expected in the strength of concrete of various mixtures and consistencies made from different brands of cement, and from different samples of the same cement, all of which conform to standard specifications.

Samples of "ciment fondu" and Lafarge "artificial ciment" (portland) were secured from the manufacturers at Marseille, France. The composition of the "ciment fondu" is approximately; lime, 50 per cent; alumina, 40 per cent; silica, etc., 10 per cent. "The cement is made in a small blast-furnace charged with coke, limestone and bauxite, and burned at a temperature sufficient to cause fusion." Concrete and mortar specimens have been made for test at periods up to two years.

Concrete and mortar tests have been made on "soliditit" cement secured from the manufacturers in Italy, which is recommended especially for road construction.

It has been proposed to use lean mixtures of cement and earth for subgrade improvement in concrete road construction.

Flexural tests supplementary to data in Bulletin 11 will give much-needed information on flexural strength of plain concrete using a wide variety of coarse aggregates. Tests are also being made on different curing conditions and grading of aggregates.

Road Building in Hawaii

(Continued from Page 173)

The high ridges—some of the peaks reaching 8000 to 12000 ft. in altitude—cut down the rain-fall behind them to less than enough for the purpose. These ridges are generally made up of thin sheets (on edge) or "dykes" of hard, impervious lava, between which are wider layers of porous material. Tunnels have been driven into the ridges through the layers or dykes for some distance beyond the ridge crests and these tunnels collect the water coming down through the softer and porous layers and serve to carry the water through the impervious dykes to the irrigation systems behind the ridges with most successful results.

Other engineering features of interest are numerous, such as the railroad work—mostly narrow-gauge—for the transportation of cane from the fields to the mills; the passenger railways over rough picturesque terrain with their numerous spectacular viaducts; the "flume-ing" of cane from the fields to the mills, and the mechanical contrivances in the pine-apple factories and sugar-mills themselves.

Though the climate and living conditions in the Islands are so delightful, easy, and conducive in many ways to a "dolce far niente" existence, it is readily apparent to a visitor that the hands of the engineers there have not lost their cunning nor have their minds succumbed to the soporific influences.

What's the use of spending thousands of dollars for an instrument to thresh grain when one can be had for almost nothing.

That is the argument that some people are making in effect when they protest against the big sums of money being spent to build good roads. Transportation is cheapened by use of an expensive machine.

A little unprejudiced thought will convince anyone of the truth of the comparison.

Commerce is fostered and prosperity insured by reliable and easy means of communication and travel. It would be no more foolish to re-adopt use of the flail than it would be to relax our efforts to build and maintain the best highways possible.

A good road is merely an instrument to reduce waste in both man-power and wheelage. As such its first cost is of small consequence. It introduces an economy into human affairs that is even greater than the difference between the flow of grain from the spout of a modern thresher and the slow and laborious garnerings of the flail and threshing floor.

Whatever measures of economy we seem obliged to take in the future in the way of public expenditures, let us not make the mistake of adopting a parsimonious program of road building.—Ellenvale Eagle.

Good roads are our best investment. They bring to the state a great army of tourists who leave much more money than we are spending in road building each year. The business man who could make a hundred per cent profit each year would be foolish not to take advantage of his opportunity, especially when he is giving full value received. We trust the legislature will give serious consideration to the recommendations of Commissioner Babcock, who has made a success of his job so far, and who best understands the problem confronting the state.—St. Cloud Journal-Press.

Current Events in the Field of Highway Engineering and Transport

ROAD BONDS FAILURE IN MINNESOTA CURTAILS 1923 WORK

State Highway Department Forced to Limit Operations This Season to Maintenance—Only New Improvements Will Be Made Under New Reimbursement Law by Counties

Minnesota's good roads program has been temporarily halted by the failure of the $20,000,000 bond bill to reach a vote in the House before adjournment of the Legislature. The state highway department has began effecting forced curtailments and no more construction contracts will be awarded this year, according to the official announcement, and only the patrol and other regular mainteannce will be carried on by state forces. Possible loss of federal aid is averted, however, by passage of the bill authorizing trunk highway reimbursement bond issues by counties which have not already profited by the plan. Re-enactment of this law will permit this year some scattered betterments. But funds available for use on the main heavy duty highways will be less than half those to be spent by county and township officials on light-traffic local roads. The highway bond bill was passed by the Senate but in the House its fair consideration was blocked by opponents using a two-thirds majority rule.

All Funds Obligated

Motor vehicle tax receipts of $6,500,000 are estimated for 1923—the same amount as was collected last year. From the $6,500,000 must be taken first $2,500,000 to meet county reimbursement bonds and interest. Then must be set aside $3,000,000 for maintenance and administration expenses. The administration fund, limited by law to $150,000 a year, pays the rent of the highway building, officials salaries and other general overhead expenses. The $1,000,000 remaining from auto tax collections will go with part of the federal aid to pay for improvements already under contract.

The list includes graveling done last winter to save about 30 per cent of the cost, also grading and bridge projects pushed with economy in cold weather.

Rules Strangle Bill

Friends of good roads in all parts of the state supported the bond bill with resolutions, petitions, letters, tlegrams and personal appeals to senators and representatives and the newspapers, with but few exceptions, backed it with the Amendment No. 1 campaign spirit. A bogie-scare that farmers opposed the plan was raised and proved one of many things which delayed and finally resulted in failure of the bill. The two-thirds rule blocking consideration of the bill toward the end, friends of the measure were obliged to attempt to change and circumvent the the rule and then developed the "parlimentary knot" which strangled the bill to death. Members favoring the bond issues fought to the end, nevertheless, to bring the bill to a vote on its merits but were unsuccessful in the house.

The Senate passed the bond bill after rejecting a $5,000,000 a year and other amendments. Although at least 70 of the 131 house members were at one time in favor of the bond issues, according to friends of the plan, the bill never got more than 64 affirmative votes on any roll call. The result on this motion to insure the bill consideration on its merits was as follows:

Yeas—Representatives Barnes, Berg, Bernard, Blum, Cain, Cullum, Curtis, Dahle, DeLury, Dilley, Duemke, Fabel, Fowler, Gehan, Giester, Girling, Green, Herreid, Horton, C. E. Hulbert, David Hulburt, O. P. Jacobson, E. Johnson, J. A. Johnson, Kinneberg, Kleffman, Lang, Lockhart, P. J. Long, MacLean, Mauritz, Mayman, McKnight, McNally, Merritt, Murphy, Naylor, Nellermore, Nimocks, Noonan, Norton, Odegard, Paige, Pattison, Pearson, C. A. Peterson, Quinn, Rodenberg, Rohne, Samec, Scallon, Starkey, Stevens, Stockwell, Strandemo, Sweitzer, O. A. Swenson, Thomas, Therrien, Trovatten, Veigel, Waldal, and Walworth—64.

Nays—A. Anderson, G. A. Anderson, S. P. Anderson, Bendixen, Benson, Bowers, Christianson, Darby, C. R. Davis, R. Davis, Day, Deans, Emerson, Enstrom, Escher, Farmer, Finstuen, Fisk, Flahaven, Forestell, Gislason, Grandstrand, Haughland, Hompe, Howard, J. N. Jacobson, Johnshoy, J. G. Johnson, Kempfer, Knudsen, Kolshorn, Lagerstedt, Lammers, Larson, Lightner, F. D. Long, Moen, Nelson, Neuman, Olson, Oren, L. Peterson, Pratt, Salmonson, Shonyo, Skaiem, Smith, Spelbrink, Spindler, Stein, E. Swenson, Taylor, Teigen, Thompson, Thorkelson, Washburn, Wilkinson and Welich—58.

Representatives Hitchcock and Masek were among friends of the bond bill not recorded on this motion.

Asked Only Fair Vote

Friends of the highway program voiced only one complaint—that no fair vote on the bond bill was secured in the House.

"No regret or ill-feeling remains," said C. M. Babcock, state highway commissioner. "Positive that the bond plan would mean more good roads for the same money and that it should be adopted, friends of the bill made every effort to clearly present the plan to the legislators and to the public. No pledges or promises were made to secure support—the fight was clean. A vote on the merits of the bill was wished but blocked by the House rules. Minnesota's good roads program will go on as planned, although progress in the next two years will not be as rapid as if the bonds were authorized."

Friends of the measure expect to present it again in the 1925 session.

MISSOURI HIGHWAY DEPARTMENT ISSUES NEW CONSTRUCTION STANDARDS

The State Highway Commission of Missouri has issued new standard specifications governing state road and bridge construction which supersede those issued in May, 1919. Instead of furnishing a copy of these specifications with each contract or for each job on which bids are invited, copies have been sent by B. H. Piepmeier, chief engineer of the Commission, to contractors, equipment companies and other interested parties with the request that they keep them in their files for future reference. In the future the Department will furnish to prospective bidders the special provisions that are bound in the proposal form but not the standard specifications. This is expected to result in considerable economy in the publication and mailing of specifications to the numerous bidders on state highway work.

NEW CEMENT RATES

Examiners of the Interstate Commerce Commission have recommended that the interstate cement rates between points in Illinois and also between points in Indiana be wiped out as unduly prejudic'al to Indiana mills and that the Commission establish a scale of rates for uniform application on cement between points in a territory embracing Southern Wisconsin and all of Indiana and Illinois. The scale of mileage rates proposed will also apply from St. Louis and Hannibal, Mo., is destinations in the territory described.

With some modifications, it may be said that the scale proposed begins with a rate of 6.5 cents per hundred pounds for 15 miles or less and increases one-half cent for every 15 miles additional or less for distances up to 100 miles. The rate for 100 miles is 10 cents; for 110 miles 10.5 cents. Up to distances of 200 miles one-half a cent is added for each additional 20 miles or less. For distances 200 or 300 miles, one-half cent is added for each 30 miles or less, and so on.

INDIANA COMMISSIONERS TO CONSIDER ROAD BIDS

Many Meetings Are Planned for First Part of May. $500,000 Is Estimate of Cost of Roads to Be Built.

While the boards of commissioners in many counties of Indiana have been making progress in their road building plans in the last two months there is a large number of projects yet to be started.

The commissioners in 25 counties will at their May sessions receive bids on roads of various types of material, the aggregate estimated costs of these projects, based on figures by county engineers, being around $500,000.

The Tippecanoe commissioners will receive bids at Lafayette on May 7 on two roads, the total estimated cost of which is $17,680.

The Clinton commissioners will open bids on three roads on May 7, the estimated cost of which amounts to $35,836.

The Huntington county commissioners have four roads on the program for which bids will be opened on May 8. The estimated cost of the four projects is $47,567.

The Allen county commissioners will hold their session at Fort Wayne on May 8, when bids will be opened on four roads, with aggregate estimated cost of $69,977.

Bids are to be received by the commissioners of Gibson county at Princeton on May 8, the estimated cost of the four projects being $63,278.

The Cass county commissioners will open bids at Logansport at their May session on two highway projects, the estimated cost of which is $70,098.

PRELIMINARY WORK ON FOREST HIGHWAY IN ARIZONA APPROVED

Expenditures totaling $70,000 of national forest highway funds for the construction of drainage structures in connection with the improvement of a road through the Coconino National Forest of Arizona have just been approved by Secretary of Agriculture Wallace. This money was made available for roads serving the national forests and for roads within or adjacent to the forests which are of primary importance to the State, counties, and communities.

The proposed work on drainage structures is a preliminary step in the improvement of the Flagstaff-Angel road through the Conconino Forest. The project embraces nearly 24 miles of highway with Flagstaff as its western terminus. The road in question is part of one of the main east and west highways through Arizona and its improvement will be of great value not only in the administrative and protective work connected with the Coconino Forest but to the public as well.

NEW JERSEY BUILDS
70 MILES OF ROAD IN 1922

The State Highway Department of New Jersey reports that, while the 1922 road program provided for the construction of 128.9 miles of highway, the embargo on open top freight cars, delay in obtaining materials, etc., confined the actual construction to 69.3 miles of durable pavement, 3.7 miles of 6-foot shoulders of bituminous concrete and 5.9 miles of completed gravel road, while 50.4 miles were more than 50 per cent completed at the end of the season.

The report states that "while the policy of the department is to construct only hard surface pavements of durable type, it sometimes is necessary to grade and lay a temporary pavement a year or two prior to the construction of the permanent pavement. This is a necessary precaution pending the final settlement of the fills. During the past year 8.8 miles of state highway were thus graded and surfaced with gravel."

The state highway system contains 725.8 miles of road and when the 1922 program is completed 302 miles will be paved with hard surface pavement and of the remainder a considerable amount of bituminous concrete in good condition, but not laid on a rigid foundation.

INDIANA TO BUILD
227 BRIDGES IN 1923

The 1923 bridge building program of the Indiana State Highway Commission calls for 227 bridges in fifty-nine counties to cost approximately $3,214,400, of which $1,045,660 will be provided by the federal government. Bridge plans were prepared by William J. Titus, chief bridge engineer and assistants.

Ninety-six bridges projects, most of which are new structures, will be built at a cost of $2,091,200 by the state and federal government, each paying half the cost. The remainder of the projects will be paid for by the state alone. The commission is also to provide inspection for a bridge over Eel river in Clay county to be built by the county at a cost of approximately $80,000.

Thirty-six of the federal aid bridges cost $15,000 or more, the largest and most expensive costing $180,000. Seventeen of the state projects will cost $15,000 or more going as high as $100,000. A list of the bridges follow:

Federal Aid Bridges

Lawrence county, over White river, $180,000; Jackson county, Muscatatuck $180,000; Jackson county, Muscatatuck Creek and Pennsylvania r. r., $100,000; Scott county, Interstate Public Service Company and Pennsylvania r. r., crossings, and Stucker creek, $100,000; Scott county, Muscatatuck river, $90,000; Clay county, Pennsylvania r. r. crossing, $25,000; Putnam county, Monon railroad crossing, $60,000; St. Joseph county, Wabash r. r. crossing, $60,000; Marshall county, B. & O. railroad crossing, $85,000; Orange county, Lost river, $33,800; same county, same river, $15,800; same county, Lick river, $15,900; same county, same creek, $28,500; same county, same creek $16,500; Lake county, under Erie railroad, $80,000; Jackson county bridge ditch, $45,000; same county, Mutton creek, $45,000; Clark county, Muddy Fork, $15,000; same county, Blue Lick creek, $16,500; same county, Coney Fork, $15,000; Scott county, Flat creek, $45,000; same county, Muscatatuck overflow, $23,000; Washington county, Mutton Fork, Blue river, $23,000; Noble county, under L. S. M. & S. railroad, $60,000; Porter county, New York Central railroad, $50,000; Lake county, B. & O. railroad, $75,000; same county, New York Central, $50,000; Spencer county, Southern railroad, $16,000; Vanderburgh county,

AMERICAN ROAD BUILDERS ASSOCIATION TO HOLD ANNUAL MEETING ON MAY 15—WILL ELECT OFFICERS AND DIRECTORS FOR 1923-1924

The annual meeting of the American Road Builders Association at which the election of officers and directors for the year 1923-1924 will take place will be held at the Automobile Club of America, 247 West 54th street, New York City, on May 15. Following the meeting which is called for 2 o'clock the annual "Get-together" dinner will be held. The list of officers to be voted for is as follows:

President

Frank Page, Chairman, State Highway Commission, Raleigh, N. C.

Vice-President, Northeastern District

E. L. Powers, Editor "Good Roads," New York, N. Y.

Vice-President, Southern District

W. F. Keller, State Highway Engineer, Montgomery, Ala.

Vice-President, Central District

S. F. Beatty, Vice-Pres., Austin-Western Road Machy, Co., Chicago, Ill.

Vice-President, Western District

Samuel Hill, Hon. Life Pres., Washington State Good Roads Assn., Seattle, Wash.

Treasurer

James H. MacDonald, Consulting Road and Paving Expert, New Haven, Conn.

Directors for One Year

Northeastern District

J. R. Draney, Sales Mgr., U. S. Asphalt Refining Co., New York, N. Y.

W. A. Van Duzer, Asst. Maint. Engr., State Highway Comn., Harrisburg, Pa.

Central District

Frank T. Sheets, Supt. of Highways, Dept. of Pub. Wks. & Bldgs., Springfield, Ill.

Directors for Two Years

Northeastern District

E. J. Mehren, Editor, "Engineering News-Record," New York, N. Y.

I. W. Patterson, Chief Engr., State Bd. of Pub. Roads, Providence, R. I.

Wm. R. Smith, Pres., Lane Construction Corp., Meriden, Conn.

Southern District

H. K. Bishop, Chief, Div. of Const., Bureau of Pub. Roads, Washington, D. C.

J. H. Cranford, Pres., Cranford Paving Co., Washington, D. C.

Central District

C. M. Babcock, Commissioner of Highways, St. Paul, Minn.

Western District

H. S. Carpenter, Deputy Minister of Highways, Regina, Sask., Canada.

Directors for Three Years

Northeastern District

S. T. Henry, Vice-Pres., Allied Machinery Co. of America, New York, N. Y.

R. Keith Compton, Chmn., Paving Commission, Baltimore, Md.

Fred A. Reimer, Engr., The Asphalt Assn., Newark, N. J.

Southern District

Chas. M. Upham, State Highway Engineer, Raleigh, N. C.

H. G. Shirley, Chmn., State Highway Commission, Richmond, Va.

Central District

Will P. Blair Vice-Pres., National Paving Brick Mfrs. Assn., Cleveland, O.

Western District

Rrank Terrace, Pres., Washington State Good Roads Assn., Orillia, Wash.

Pigeon creek, $30,000; Spencer county, Lake Drain creek, $19,600; Marion county, Big Eagle creek, $23,000; Warren county, Wabash railroad, $24,000; Allen county, Eel river, $15,000; same county, G. R. & I. railroad, $20,000.

State Bridges

Warren county, Big Four railroad, $100,000; Davies and Pike counties, East fork, White river, $100,000; Wayne county, drainage ditch, $19,000; same county, drainage ditch, $23,000; Dearborn county, structure, $20,000; Fountain county, Coal creek, $16,500 same county, Shawnee creek, $19,500; Vermillion and Park counties, Wabash river, $24,000; Blackford county, Salamonia river, $40,000; Owen county, White river, $20,000; Montgomery county, Sugar creek, $19,000; Franklin county, Big Four railroad canal, $60,000; Switzerland county, Indian creek, $23,000; Scott county, B. & O. railroad, $40,000; Spencer county, Anderson river, $40,000.

INDIANIA ROAD COMMISSION BUYS CRUSHED STONE

$50,000 Worth of This Material to Be Used on 13 State Highways

The Indiana Highway Commission has placed orders for crushed stone and gravel to the amount of $50,000, and active operations will soon begin in placing non-rigid type roads in good condition for spring and summer traffic. This material will be distributed over 13 state roads and as they are repaired other highways of the Indiana system will receive attention as they show wear.

Members of the commission recently returned from a trip over southeastern Indiana highways which they found in good condition. "Contractors are busy on new state highways throughout Indiana," said John D. Williams, director of the commission, "and work on them will be pushed to completion."

The commission will this year build about 50 miles of roads of the penetration type, and the locations will be announced soon.

PENNSYLVANIA TO RESUME PUBLICATION DETOUR BULLETIN

The Pennsylvania State Highway Department has announced that it will resume the publication of its weekly detour bulletins; and in addition to the information as furnished in preceding years will issue weekly a map of the State Highway system, showing the exact location of each detour. The department, through its Extension Bureau, will also continue to furnish information concerning Pennsylvania roods to all who inquire.

The department states that beginning May 1 a detour will exist until September 1 on the main north-south road between Sunbury and Harrisburg. This detour is between Selinsgrove and Liverpool. It extends from Liverpool to Millerstown and Thompsontown, where the road turns north through Cocolamus and Mount Pleasant Mills to Selinsgrove. It is 45 miles in length, and in good condition.

Important Oiling Schedule

The oiling schedule of the department for the week ending May 5 will include the following important sections of thoroughfare:

William Penn Highway—Between Paxtang and Hummelstown; between Limerick and Douglassville; between Pottstown and Reading.

Lincoln Highway—Between Chambersburg and Fort Loudon; between Whiteland and Paoli; between Greensburg and Ligonier; between Greensburg and Pittsburgh.

Other scheduled operations are as follows:

On the Horseshoe Pike between Cornwall and Lancaster County line and between Blue Ball and Ephrata; between Carlisle and Mount Holly; between Mildoy and Lewistown; between Blairsville and Lebanon County line; Quarryville and Christinana; New Castle and New Wilmington; Valencia and Butler; Adamstown and Reading; Weissport and Harrity; Delaware Water Gap and East Bangor; Easton and Martins Creek; York Haven and Newberry; Zionville and York; Willistown and West Chester; Oxford and Russellville; Parkesburg and Compass; Coatesville and Doe Run; Indiana and Gilpin; Indiana and Blairsville; Stroudsburg and Bushkill; Stroudsburg and Analomink; Mountain Home and Mount Pocono; Washington and Canonsburg.

EMPLOYMENT OF ENGINEERS CONTINUES STRONG

Engineering services continue in demand in most sections of the country, particularly in the middle West, and the outlook for technical employment is active and favorable. There is also an increased confidence that good business will continue, which will lead to more construction providing labor and materials are not beyond reasonable figures.

The demand for designing engineers is expected to continue for some time. The enormous amount of plans being prepared indicates an up-tone of strength and a large demand for construction engineers and estimators, for the immediate future. The outlook in building construction bids fair to continue vigorously for some time.

Engineering activities are starting to show signs of life in the Northwest section where weather conditions caused a general pause. In California, engineering work continues good. The Southwest section shows poor for the civil engineer but excellent in the mining field. The mountain states show an early spring start with a number of general engineering projects underway. The Central States indicate a large volume of construction work, much of which is being rushed to completion and a large volume of new work being started. Building permits in Chicago for the month of January showed an increase in valuation of 125 per cent. over January of last year, and similar large increases in other cities of the middle West. The coal mining region indicates continued activity with a fair demand for technical services. The Southern States are showing increases in building construction with a fairly large road program in the most of the states. Engineering work is not as active in the Eastern States, particularly New York and Massachusetts, and business is not as optimistic, although the supply and demand of engineers about balance.

CALENDAR OF COMING MEETINGS

AMERICAN ASSOCIATION OF ENGINEERS, Annual Convention, Norfolk, Va., May 7-9.

AMERICAN ROAD BUILDERS ASSOCIATION, Annual Meeting, New York, May 15.

AMERICAN SOCIETY FOR TESTING MATERIALS, Annual Meeting, Atlantic City, N. J., June 25-29 or 30.

DIXIE HIGHWAY ASSOCIATION, Annual Meeting, Chattanooga, Tenn., May 24-26.

CUSTER BATTERFIELD HIGHWAY ASSOCIATION, Annual Convention, Sioux Fall, S. D., Sept. 20-21.

SOUTH ATLANTIC COASTAL HIGHWAY ASS'N HOLDS MEETING

The South Atlantic Coastal Highway Association held a meeting at Charleston, S. C., on March 15th, at which representatives were present from North Carolina, South Carolina, Georgia, and Florida. The asociation announces that a federal highway from Washington, D. C., via Richmond, Norfolk, Wilmington, Charleston, Savannah, Brunswick and Jacksonville to Miami, hugging the coast from Norfolk to Miami, will probably be a reality by the winter of 1924, "with permanent bridges crossing the streams and rivers between the points mentioned." The association has been working on this project for several years.

DIXIE HIGHWAY ASS'N TO HOLD ANNUAL MEETING, MAY 24

This year's annual meeting of the Board of Directors of the Dixie Highway Association will be held at Chattanooga, Tenn., May 24th, 25th and 26th, with headquarters at the Hotel Patten. According to a recent anouncement by Judge M. M. Allison, President of the Association.

The election of officers, which takes place only every two years, will occur this year and other important matters to be discussed will be the question of revoking several designations of the Dixie Highway System where counties or organizations have failed to live up to original contracts and agreements. Final action will also be taken on the new routing on the west coast of Florida from Valdosta to St. Petersburg, via Lake City-Ocala-Dunnellon and Brooksville, which was made a tentative part of the Dixie Highway System at the annual meeting held last May at Jacksonville, Fla. Frank B. Shutts, of Miami, Chairman of the Florida Directors, having this matter in charge, will attend the Chattanooga meeting and make a full report on this route. The Carolina division from Knoxville to Waynesboro via Asheville, Greenville and Augusta will be brought up for discussion. A report will be called for at the meeting from representatives of the two routes between Cincinnati and Lexington and it is that a final decision will be reached regarding these routes during this meeting.

Invitations have been sent out from the Dixie Highway Association at Chattanooga to the governors of the ten states traversed by the Dixie Highway inviting them to attend this convention, as was done by the governors of these states in 1915 when plans for building the Dixie Highway were formulated. The states traversed by the Dixie Highway are Michigan, Indiana, Illinois, Ohio, Kentucky, Tennessee, Georgia, Florida, North and South Carolina. In view of the important business that is scheduled to come before the Directors, it is expected that the meeting will be largely attended.

NEW CEMENT PLANT TO BE BUILT IN CALIFORNIA

One of the largest lime and cement plants in the United States is to be erected by the Guadalupe Lime and Cement Company at San Jose, Calif.

The company has secured approximately 1,000 acres on the Almaden road, upon which is will eventually construct $2,500,000 worth of buildings, including equipment.

Preliminary surveys and right of way construction have been under way for some time and actual work on the plant will begin in a few weeks. The plant will employ about 300 men when completed.

SOUTH CAROLINA MAKES MARKED HEADWAY IN DEVELOPMENT OF ITS ROADS DURING 1922

The State Highway System of South Carolina, on January 1, 1923, contained 3,519 miles, of which 3,225 miles had been proposed for Federal aid. Based on 7 per cent of the public road mileage of the State, 3,662 miles is eligible for federal aid.

During 1922, 73 miles of hard surface roads were constructed, giving a total of 158.8 miles of hard surface constructed to date, while 41 miles were under contract. During the year 475 miles of types other than hard surface were constructed and 225 miles under contract. Altogether 2,307 miles of the state system were either improved or under contract by the first of this year. The State Highway Commission reported that 300 additional miles of hard surface were needed to care for the present traffic and that 913 additional miles of other types were needed.

During the year surveys made for which the records are complete totalled 215.85 miles, the cost of this work being $16,047, an average cost of $74.34 per mile. Plans were prepared for 440 miles at an average cost of $48.10 per mile.

Seventy-four contracts were let during the year, the greatest number in any one month being 14 in May, 16 having been let prior to that month. The unit costs of the successful bids during the entire year averaged as follows: Clearing and grubbing $91.77 per acre, common excavation 26c per cubicyard, rock excavation dry $1.67 per cubic yard, rock excavation wet $4.66 per cubic yard, top soil surfacing 27c per cubic yard, sand-clay surfacing 24.7c per cubic yard, clay-gravel surfacing 23c per cubic yard, clay bound macadam 46.5c per square yard, shaping subgrade $2.00 per thousand lineal feet, gravel surfacing $1.37 per cubic yard, bituminous concrete surfacing 94.7c per square yard, plain concrete surfacing $2.48 per square yard, reinforced concrete surfacing $2.87 per square yard, concrete base $1.51 per square yard, sheet asphalt surfacing 98.5c per square yard, rock asphalt pavement $2.00 per square yard, shell surfacing 78c per square yard. Class A concrete $20.83 per cubic yard, Class B concrete $18.22 per cubic yard, Class C concrete $20.25 per cubic yard.

At the beginning of 1922 the state had under maintenance 1,319 miles and at the end of the year 1,910 miles, an average of 1,603 miles during the year. The total cost of state maintenance was $382,361, an average of $240.68 per mile. The Commission states: "In considering the cost per mile for maintenance, it should be remembered that the funds available for maintenance in some of the counties have been altogether insufficient and in those cases the roads have suffered in consequence."

Equipment—Trade—Materials

FOUR WHEEL DRIVE TRUCK USED WITH ASPHALT SPREADER

One FWD truck equipped with a specially designed pressure asphalt spreader was the only transportation equipment used by the United Paving & Construction Company of Vancouver, B. C., in hauling and spraying the hot asphalt on a nine mile asphaltic macadam (penetrating system) paving contract last summer. In the record time of three months this equipment hauled and sprayed 270,000 gal. of hot asphalt over the nine miles of road.

The truck is the product of the Four Wheel Drive Auto Company of Clintonville, Wisconsin, and the pressure distributor is of a special design adapted to use on this truck. In this work it is necessary, when the asphalt is being sprayed, that a special low speed be maintained during the operation. To take care of this requirement a special low gear ratio in the truck allows it to travel as slowly as one-half mile per hour in low gear with a capacity load. The asphalt distributors on this outfit are so arranged that they may be used on roads 8, 12 and 16 ft. in width. An arrangement is made for the connection of a hand distributor to be used in covering small patches on corners and in cramped quarters, which are hard to get at with the regular distributor equipment. So successful was the operation of this equipment last season that its owners are adding another unit of the same kind to their equipment in anticipation of an increased volume of work during the coming season.

THE CARR ROAD FORM

The Lakewood Engineering Company has recently placed on the market the Carr Road Form, incorporating a number of distinctive features. The locking arrangement consists of two simple wedges and insures accurate and rigid connection of sections. The sections of form are made in 12-foot lengths, which is 20 per cent longer than has been customary for road forms, and decreases the number of joints to be made and the sections to be handled in a given distance.

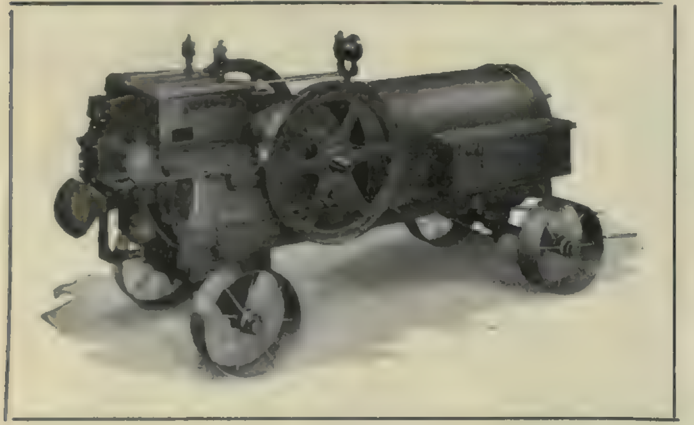
One of the important features of the form is the Line Point Top Surface, which is secured by the rounded top. No concrete or stones can lodge here to get under the wheels of the finishing machine or subgrader to cause them to ride high.

Flat stakes having a penetration of 18 in. and which can be driven anywhere along the base of the form are another feature of the Carr Road Form. The shape of the stake gives it maximum resistance against displacement. The base is 5 in. wide and furnishes ample bearing to support the form when carrying mechanical finishing and subgrading machines.

AIR COMPRESSOR OUTFITS

The "Schramm" line of portable engine driven air compressor outfits has been manufactured for over twelve years and met with ever increasing favor each year. During the past year, however, radical changes have been made in the governing, ignition and fuel feed systems. The original principle of direct-connecting the engine to the compressor by means of a two-throw crankshaft is still used, as it has been found to be the most satisfactory design. The crank arms are set 180 deg. apart and while the engine connecting rod and piston are traveling in one direction, the compressor connecting rod and piston are traveling in the opposite one, insuring a perfectly balanced outfit. In addition to this, all fly-wheels have heavy counterweights in them which help insure a steady running, even-balanced unit.

The compressor is a single-acting, single cylinder unit. The compressor valves are of the very latest disc type, located in large valve cages which give easy access to all incoming and outgoing air. Both engine and air compressor have large water-hoppers cast integral with the cylinders. This eliminates all fans, radiators and water-cooling tanks with their attendant leaky joints and delays due to breakage of belts, gears or other apparatus used in driving the fan.



"Schramm" portable air compressors differ from the old ones in many respects. Air tanks have been enlarged, the capacities of the compressors themselves have been increased and the operating efficiency of these units is higher today than ever before. The trucks are heavier and all outfits embody the new features of the engines and compressors. The outfits today are more dependable and more automatic in their operation than ever before.

The amount of pressure obtained from these outfits is in direct proportion to the amount of air used by the pneumatic tools. This automatic feature is obtained by the pressure regulator on the compressor, which can be adjusted by the operator while the machine is in motion. The engine in turn, has sufficient power to easily operate the compressor at its maximum pressure and air delivery, but the governing system on the engine automatically regulates the fuel in accordance with the demands made by the compressor. If only a small amount of air is being used, the compressor will make no more than is required and the engine in turn will not use any more fuel than is required to make such amount of air.

The six sizes in which these outfits are built, ranging from 15 to 140 cu. ft. of free air per minute, makes it possible to select an outfit that will operate any pneumatic tool required in the contracting and construction trade. Over six thousand units are being used for rock drilling on road, sewer, foundation and quarry work, street repair work, calking and testing pipe lines, tamping, sand blasting, etc.

These units are manufactured by Schramm, Inc., West Chester, Pa., who have branch offices located at 709 Arch street, Philadelphia; 54 Dey street, New York; 504 Mission street, San Francisco, and 1007 Van Nuys Building, Los Angeles.

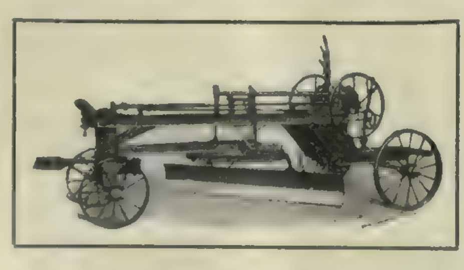
STOCKLAND MASTER QUICKLIFT GRADER

The Stockland Master Quicklift illustrated, manufactured by the Stockland Road Machinery Company of Minneapolis, Minn., embodies the characteristics of the maintenance grader with those of the light construction grader. It has the light running, easy operating, fast running qualities that cut the cost of maintenance work. It can be used with four horses in this type of work, and it is built strong enough for six horses or a 12 h.p. tractor and thus bridges a gap between strictly maintenance machines and the larger construction machines.

Naturally for this type of work the Quicklift is a tremendous advantage. For street work especially, where there are numerous crossings, manhole covers, and alley-ways, the Quicklift is a genuine money saver. It avoids obstructions such as crossings, manhole covers with a single pull on the Quicklift lever. The blade is thus instantly raised and when again lowered by the Quicklift lever is returned to its exact former adjustment.

Another valuable feature is the built-in steering device which is furnished for engine-pull Masters. The Stockland steering device involves no overhead rods running down to the draft pole. This much-used method involves universal knuckles which cease to function when the pull is offset more than about 30 degrees or 35 degrees. The Stockland steering device, on the other hand, is built into the machine and never loses control of the front wheels.

The Stockland Quicklift Master has the regular Stockland curved moldboard with the cutting blade. The cutting in and down by the blade creates a sucking down force which assures a clean, uniform cut and also holds the wheels snug to the road and prevents slewing or skidding. In hard packed streets or roads this feature saves time and money. It does not chatter or scrape over hard surface and thus eliminates the need for regrading.



The weight of the grader is 2450 lbs. and blades can be furnished in 6, 7¼, or 8 ft. lengths as desired.

CEMENT PRODUCTION INCREASE IN MARCH

Production of portland cement during March was unusually heavy for this season of the year. Mills of the country produced nearly 9,900,000 barrels, almost 2,000,000 barrels more than in February and nearly 50 per cent more than in March, 1922. Production for the quarter ending March 31 was considerably more than 25,000,000 barrels as compared with an average of slightly over 17,000,000 for that quarter during the five year period 1919-1923.

Shipments from the mills during March, 10,300,000 barrels, established a high mark for that month and were more than 47 per cent greater than in March, 1922. For the first quarter of the year shipments were 21,500,000 barrels, a quantity greatly in excess of the amount moved in any similar period and approximately 54 per cent higher than the average for the five year period 1919-1923.

Stocks of finished cement in manufacturer's hands decreased about 450,000 barrels for the month or less than 4 per cent.

Personal Mention

J. M. Angle is now highway bridge engineer with the U. S. Bureau of Public Roads and stationed in Washington, D. C., having but recently left Pittsburgh, Pa., where he was employed as a special draftsman in the Allegheny County engineer's office.

A. G. Briggs, until recently resident engineer with the North Carolina State Highway Commission, has entered private practice, being located at Locust Dale, Va.

Rollin J. Windrow has resigned as consulting engineer for the Missouri State Highway Commission and personal representative of Theodore Gary, chairman of the commission, to devote his time to personal business. Mr. Windrow is connected with the firm of Smith Bros., prominent general contractors of Dallas, Texas.

A. C. Lingley, who has been division engineer for Division 4 of the Missouri State Highway Dept., with offices in Kansas City, since last Spring, has been appointed construction engineer for the Highway Department with offices at Jefferson City. His successor is W. M. Spann, who has been acting construction engineer of Jefferson City.

F. W. Richardson, Governor of California, has named Nelson T. Edwards, member of the board of supervisors of Orange County, as the third member of the California State Highway Commission. The other two members are Harvey M. Toy, San Francisco, chairman, and Louis H. Everding, Eureka.

GOOD ROADS

Title Reg. U. S. Pat. Off.

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Minnesota Reports Big Road Year

Greatest Progress in Highway Development Made Last Year, According to Official Figures—Trunk Route Improvement Program Already More Than Half Completed

Minnesota trunk highway improvements last year included 1,621 miles of grading, 1335 miles of graveling, 147 miles of paving and 185 new bridges, exclusive of betterments from maintenance operations extending over the entire 7,000-mile trunk highway system. The figures are from the annual report of Charles M. Babcock, state highway commissioner, which is now being circulated.

New progress records made on state highway work are said to be equalled or exceeded by those on secondary or local roads throughout the state, although only partial compilations of reports by county and township road officials are available. Relieved of the heavy expense of improving and maintaining the main highways which formerly took an average of 80 per cent. of the road and bridge funds, it was explained, counties are left with five times as much money with which to push local road betterments.

Highway officials said that 1922 was a high record year of highway development in Minnesota. Failure of the highway bond proposals in the recent legislature, as already made plain, means that the 1922 progress on the trunk system will not be approached this year or next, the large part of available funds to be taken for upkeep and repairs and little to be left for further improvements.

Improved Mileages Run Up

Rapid progress to date under the new state highway program is shown by comparisons with improvement totals listed by counties when the trunk highways were turned over to the state. The state in two years has spread improvements measuring 5015 miles, compared to 2936 miles reported as improved when counties were relieved of the responsibility for the trunk routes.

The summary follows:

Miles	At Start	New Plan	Total
Graded	1499	2267	3766
Graveled	1371	2398	3769
Paved	66	350	416

In addition, there has been much new bridge construction, state maintenance forces reshaped 982 miles and resurfaced 804 miles and patrol forces carried early good roads benefits to every part of the big system. Although less than 4000 miles of the 7000 miles of trunk highways are completely improved, surfacing doubling on the grading, a conservative estimate is that the state highway program is more than half finished.

County Lines Remain

A significant feature of the highway report is a showing that more than three-fourths of the money used on the state trunk highways under the new plan has been county reimbursement bond funds and federal aid. The Good Roads Amendment No. 1 principle was one for a state highway system to be improved without regard to county or other lines. A legislative trend in the opposite direction is disclosed by the figures and its continuance in the extension of the county reimbursement bond law and the failure of the trunk highway bond bill in the recent session.

The requirement that reimbursed funds be used in the counties issuing the bonds has resulted in much disconnected improvement on the system. A further tendency is to increase the mileages of paving, county boards urging use of bond funds for hard-surfacing because other improvements may be looked for under the regular state program. The commissioner's report makes no direct comment on these matters but they are plainly apparent from the tabulations.

Fund Uses Detailed

Use of average highway dollars expended last year is given in several tabulations. Of the average dollar of income, 66.5 cents went into new construction, 27.3 cents into maintenance, 4.8 cents for equipment and 1.4 cents for general administration expenses. Division of the construction dollar follows: Grading, 30.8 cents; graveling, 22.6 cents; paving, 23.5 cents; bridges, culverts, etc., 18.3 cents, and many other items such as clearing, guard rails, etc., 4.8 cents.

Use of the average dollar expended for maintenance is shown in two ways—by class of work and by commodity. Division by work shows: patrol cost, 50.8 cents; repairs and replacements, 23.4 cents; betterments, 13.8 cents; office and field expenses, 7.8 cents, and special items, 4.2 cents. Labor took 76.7 cents of the average maintenance dollar, according to the second distribution, and of the remainder 15.5 cents for general operation and equipment items and 7.8 cents for materials.

Mile Costs Are Shown

Mile costs of state trunk highway improvements averaged the lowest of record in the 1922 figures given in the report. Grading was contracted at an average of $6,030 a mile, $420 more than in 1921 but less in consid-

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eration of larger percentages of rock excavating and other unusual work which run up the figure. Gravel surfacing was contracted at $2,793 a mile on the average, against $3,383 the year before, and paving at $28,276, compared with $35,520 paid the year before.

Trunk highway averages of maintenance costs are given as follows: dirt roads, $278.90 a mile; old gravel roads, $511.65 a mile; new gravel roads, $368.86 a mile, and paving at $136.30 a mile.

Commissioner Babcock's 1922 report accounts for the year's highway funds in great detail, by counties, trunk routes, revenue sources and so forth. It contains the full traffic census report, tabulations on state aid roads, numerous illustrations and other informative matter. The report covers the full year and its publication is regarded as prompt inasmuch as statements from sixteen divisions were necessarily collected and distributed in the many tabulations it contains.

Virginia Has New Highway Department

A reorganization of the State Highway Department of Virginia was required by acts of 1922 General Assembly, and the reorganization became operative on January 1, 1923. The new department is in charge of five commissioners, selected from the five geographical divisions of the State but each representing the whole State rather than his division. One member of the commission is to be chairman and devote his entire time to the work and will be the executive of the commission. There will be two principal departments, executive and engineering, the former having sub-departments of auditing, purchasing, legal, right of way, and statistical and filing.

Engineers have been appointed by George B. Coleman, State Highway Commissioner of Virginia, in his plan for reorganizing the engineering branch of the department. The assistant engineers will be C. S. Mullen, in charge of construction; J. J. Forrer, in charge of maintenance; W. R. Glidden, in charge of bridges; A. H. Pettigrew, in charge of state aid; B. P. Harrison, in charge of service; Tazewell Ellett, in charge of office; Shreve Clarke, in charge of tests, and E. M. Evans, in charge of equipment.

Eight districts have been laid out, each to be in charge of a district engineer, while each district will be sub-divided into five residence districts, each in charge of a resident engineer. The district engineers selected are: George T. Lemmon, A. H. Bell, R. P. Ellison, J. C. Albright, C. D. Scott, H. T. Ammerman, T. F. Loughborough and J. D. Keeler, Jr.

Ohio Highway Construction Statistics

The Department of Highways of Ohio has recently issued a report containing some interesting statistics. The work placed under contract by the department during the past four years has been as follows:

1919, 535.931 miles at a contract price of $15,695,130.39; 1920, 412.167 miles at a contract price of $12,866,119.89; 1921 393.806 miles at a contract price of $13,774,596.47; 1922, 714.268 miles at a contract price of $21,152,315.90.

The mileage placed under contract in 1922 was divided among the various types as follows:

Bitoslag, 1.427; bitulithic, 2.003; brick on concrete base, 90.964; brick on rolled base, 81.810; monolithic brick, 31.251; semi-monolithic brick, 2.490; bituminous concrete, 32.723; bituminous macadam, 168.598; plain concrete, 41.671; reinforced concrete, 158.584; grading and culverts, 51.482; gravel 7.505; Kentucky Rock 18.570; waterbound macadam, 10.626; and widening and resurfacing, 14.564 miles. The 1922 construction program also included thirty-nine bridges.

At the end of the 1922 season 549.1 miles under contract were officially listed as carried over to 1923. Of this mileage, however, 279 miles were practically completed and opened to traffic, leaving approximately 270 miles of 1922 work to be built in 1923. A considerable amount of construction has, however, been done on this mileage.

Georgia Lets Road Contracts for $500,000

Contracts on road projects in nine Georgia counties, aggregating more than $500,000 have just been let by the State Highway Department, it was announced by John M. Holder, chairman of the State Highways Commission.

The largest contract let was for the construction of five miles of chert roads in Polk County, awarded to the R. L. Killian company on a bid of $104,525.36. The Nichols Construction Company had the best bid—$86,862.73—on the construction of eight and 996-1000 miles of top soil road in White County. A contract for the construction of seven and 1-10 miles of sand-clay road, 11 creosoted timber bridges, and one 100-foot steel span bridge in Bibb and Wayne counties was let to Dales and Company for $57,739.42, and the construction of three and 32-100 miles of top-soil road, to cost $38,153.25, in Lumpkin County, went to T. P. Wright.

Ideal Section of Lincoln Highway to be Completed June 15

Work on the completion of the Ideal Section of the Lincoln Highway in Lake County, Indiana, 37 miles south of Chicago, has been resumed, and officials at the headquarters of the Lincoln Highway Association state that if the present fine weather continues, all work on the Ideal Section may be completed by June 15th. The paving and bridge and culvert incorporated in the section were completed last season, and the work now being done comprises the grading of the shoulders, construction of the gravel pathway for pedestrians, the installation of the illuminating system for night traffic, and the beautification of the roadsides.

This beautification work, which is under the direction of Jens Jensen, landscape architect, of Chicago, is expected to set a precedent in the handling of roadsides in America. Nothing but native plants and shrubs, indigenous to the country in which the section is constructed, will be used but every effort is being made to develop a harmonious plan which with modifications can be adapted along the Lincoln Highway and other main roads anywhere between Omaha and New York City.

Intense interest in the development and maintenance of the Ideal Section has developed in Lake County. An organization of all property owners along the Lincoln Highway in the county has been proposed, the aim being continuous maintenance of the roadsides and abutting property as well as the road itself. Public spirit and natural pride of possession is making itself manifest and the people and officials of the county propose to take great care in not only guarding the appearance of the Ideal Section itself but the entire route through the county.

Indiana Road Contracts Total $154,386.00

County Commissioners Obtain Bids Below Estimates—Contractors Await Favorable Weather to Begin Work

Boards of county commissioners over Indiana let many road contracts at their April sessions, and the successful bidders only await favorable weather to start construction work. Only in a few instances have bids been beyond estimates of county surveyors and engineers, while most of them are well below the estimates. Contracts totaled approximately $154,386.

Contract lettings reported by county auditors are as follows:

Warrick County—The contract for the Lynn-Louis Tyring road has been let to Fowler & Owens, of Newburg, Ind., at $33,495.

Vigo County—The commissioners have awarded the contract for the Paul M. Fisher road to Woods Bros., of Universal, Ind., at $11,708.60.

Morgan County—The commissioners received one bid on the John Gant road, it being $24,350 and made by Glen Brown, of Coatsville, Ind.

Wells County—The low bidder for the construction of bridge No. 139 was James Crosby, of Bluffton, his figure being $1,700.

Perry County—The contract for the Sylvester Moseby road, 9,160 feet long, has been let to W. H. Lanman and Sylvester Moseby, of Bristow, at $6,600.

Huntington County—The contract for the Jacob G. LaMont road, 14,868 feet long, was let to Essinger & Betts, of Columbia City, at $16,974.50.

Gibson County—The commissioners received proposals on the J. E. Joyce road, the lowest being that of English & Lemasters, of Petersburg, $14,880. The contract was not let, the commissioners taking it under advisement.

Ohio County—The commissioners have let the contract for the George D. Hanna road, 19,040 feet long, to McIntire, Hopping & Rininger, of Cleves, Ohio, at $27,995. The estimated cost was $31,138.

Miami County—The commissioners have awarded to Shaw & VanCleave, of Roann, the contract for road No. 7 at $7,924. The estimated cost was $12,200.

Approximately 19 miles of a fifty mile program of bituminous macadam paving to be constructed this year by the state highway commission has been designated, by John D. Williams, director. The mileage designated will be let in seven project awards, and five counties are effected, Mr. Williams says. Counties wherein the first bituminous macadam will be laid in this program are Wells, Wayne, Allen, Lawrence and Monroe.

Roads on which this type of surfacing will be laid, and the location of same, are as follows:

Road 13, in Wells county, extending from the brick pavement in the town of Ossian, in a southerly direction 5.96 miles. Date set for completion, November 15.

Road 3, in Wayne county, extending over certain parts from the west corporation line of Richmond, in a westerly direction to the east and of the concrete road, 1.07 miles. Date set for completion, Nov. 3.

Road 3, in Wayne county, extending from the east corporation line of Richmond, in an easterly direction to the Indiana-Ohio state line, 97 miles. Date set for completion Nov. 15.

Road 14, in Allen county, extending from the south corporation line of Ft. Wayne in a southerly direction, 3.47 miles. Date of completion November 10.

Road 44, in Allen county, extending from the west line of Ft. Wayne, in a westerly direction, 0.80 miles. Date set for completion November 10.

Road 22, in Lawrence county, extending from the north corporation line of Oolitic to the village of Needmore, 2.1 miles. Date set for completion, Oct. 15.

Road 32, in Monroe county, extending from the junction with State road 22 at the north corporation line of Bloomington, in a northwesterly direction, 2.25 miles. Date set for completion Oct. 15.

Work on Wolf Creek Pass Colo. Road to Start Early Part of June

The coming summer will see the completion of the work on the State Highway over Wolf Creek Pass, Colorado, one of the State's most important east and west roads and the chief highway leading into the San Juan country and to the Mesa Verde National Park. When heavy snow storms stopped the work last fall, the steam shovel used to widen the old road and to cut down heavy grades, together with supplies, was cached near the top of the pass. As soon as the weather permits, a crew of men will be sent to the pass and the work resumed where it was left off last fall. Sufficient money has been set aside to complete the road on the west side of the Divide.

With the work completed the road over Wolf Creek Pass, one of the most attractive, scenically, will be as safe and easy to negotiate as any mountain road in the State.

With the arrival of warm weather the laying of concrete on the North and South Highway, from Broomfield north, will also begin. Grading will have been completed within a few weeks. Due to the fact that the engineers' plans call for cutting down the grade of the highway from the Interurban crossing, north of Broomfield, to the top of Goodhue Hill, those in charge of construction work have been compelled to close the road for traffic of every sort.

An excellent detour has been provided. Until the project has been finished and, perhaps, until the next stretch, from the top of Goodhue Hill to Lafayette has been completed, all traffic will be routed over the road which branches off the North and South Highway just south of the Interurban crossing north of Broomfield. This is the road to Boulder via Marshall. It is followed for a short distance and then the automobilist turns upon a country road which leads him into Lafayette.

The detour has been newly graveled and road signs have been provided.

Road Census of Montana

Montana now has 29,279 miles of improved roads, not including that added during last season, according to the Bureau of Public Roads, United States Department of Agriculture, which has made a complete census in the state. The improved road mileage at the beginning of 1922 was as follows: Graded and drained, 27,507; sand clay, 15; gravel, chert and shale, 1,716; waterbound macadam, 5; bituminous macadam, 2; cement concrete, 32; miscellaneous, 2. The total road mileage of the state is 64,732 miles, as compared with 39,204 miles in 1914, and during the seven-year period from 1914 the graded and drained mileage has increased from 6,528 to 27,507, and the surfaced and paved roads from 609 miles to 1,772 miles. The total road revenue in 1921 amounted to $10,031,901 or $68 for each square mile of area, $155 for each mile of road, or $18.28 per capita.

Billboards on Curves Are Forbidden by New State Law

In the future it will be unlawful to erect a billboard or advertising sign on any public highway of Colorado, within 300 ft. of a crossing or upon a curve in such a manner as to obstruct the full view of the curve. The general assembly has enacted into law a bill by Representatives Lake, of Denver, and Niven, of Boulder, forbidding the erection of billboards and advertising signs. Violations are punishable with a fine of not less than $25 and not more than $100 or a jail sentence ranging from ten to thirty days, or by both fine and imprisonment.

The bill, which had the backing of almost every motoring organization, will eliminate a great source of danger on Colorado's highways, besides, it will prevent the marring of the landscape through ugly signs.

England Experimenting with Rubber Roads

Experiments with rubber paving are now being carried out in Manchester on the road leading to the works of Messrs. Charles MacIntosh & Co. Instead of the usual method of laying small blocks of rubber singly, as in the case of wood paving, large slabs of rubber 2 in. thick are to be used, each slab weighing about 600 lb., so that the possibility of "creeping" or "lifting," as experienced in previous attempts, is reduced to a minimum. The surface of the slabs is corrugated to give the appearance of small setts, and this supplies a safe foothold for horses. In addition, the slabs are reinforced at intervals with steel bars, which keep them rigid while retaining the necessary pliability to ensure noiselessness. Part of this roadway is laid with smaller slabs of the same type, in connection with which a new system of interlocking has been devised, and the respective merits of the two methods are to be carefully observed. The whole is placed on a concrete foundation and the joints are cemented with tar. The firm have had considerable experience in the making of these roadways, and as far back as 1876 they laid rubber in St. Pancras Station, London, and again in 1881 at Euston; portions of the roads are still in existence. In 1904 they paved the entrance to the Midland hotel, Manchester, and notwithstanding severe wear no repairs have been necessary as yet.

According to Indian Engineering, experiments are also being made in Colombo with road paving consisting of a mixture of rubber, maxphalite and picoleum, but has proved a failure. Another preparation subjected to a test up country on estate roads was, on the other hand, very successful. It was found capable of eliminating dust entirely, while so far as its wearing properties were concerned, an estate road treated with the solution two and a half years ago still showed no real signs of wear. The solution, in appearance, it is stated, resembles tar, and is delivered in solid form in barrels. The method of laying on the road is similar to that employed with tar and asphalt preparations, it being heated until it is liquid and then spread on the road with brooms. After the dressing is applied to the road a fine gravel is sprinkled on the surface and then a light roller run over. The experiment tried upcountry showed that it is not so sticky as tar and rather easier to spread, and twelve hours after it had been applied it was found to have set and the road usable for traffic. The mixture is said to have been composed of pure bark and scrap rubber, and although the cost is slightly higher

Forest Service To Build New Highways in Nevada and New Mexico

Additional expenditures totaling $58,657 to apply on the construction of 2 road projects in Nevada have just been approved by Secretary of Agriculture Wallace. This money is to be taken from the national forest highway funds which were made available for roads serving the national forests and for roads within or adjacent to the national forests which are of primary importance to States, counties, and communities.

Of the $58,657 just approved for expenditure, $37,000 is to apply on the Austin East Highway project and the balance, $21,657, on the Currant Creek project. Including these expenditures the amounts approved for these two roads total $251,000 of which $152,000 is for the Austin East road and $99,000 for the Currant Creek project. Not all of the sums approved, however, are from the national forest highway fund, some of the money having been set aside from other Federal road funds.

The Austin East project is to be 16½ miles in length, beginning at the east end of the Austin-Eureka road in Lander County. The road touches the Toiyabe National Forest and is a section in one of the main east and west highways through the State.

The Currant Creek project will cross the line between White Pine and Nye Counties and is partly within the Nevada National Forest. As now planned this road when completed will join on the west with a section of highway being built by the Nevada Highway Commission. The highway in question is a part of the National Trail and is important as a connecting road between different parts of the Nevada National Forest.

Expenditures totaling $205,890 of national forest highway funds for the construction of about 12 miles of highway in New Mexico between Canonçito and Pecos have been approved by Secretary of Agriculture Wallace. This money was made available for roads serving the national forests and for roads within or adjacent to the forests which are of primary importance to the State, counties, or communities.

The road in question is a link in the main State highway system which is used by trans-State auto travel to a greater extent than any other road in the State. The proposed construction project which embraces the poorest section of the forest road between Las Vegas and Santa Fe lies partly within the Santa Fe National Forest. When completed it will greatly facilitate the administration and protection of the forest and will also aid in opening up the recreational advantages of the forest by providing a better route of travel to the connection with the Glorieta-Paschuella Road which is of such great value to recreation seekers.

than that of tar, it is more effective as a dust preventive and gives better wear. The fact that the preparation requires no vulcanizing operation, it is suggested, is an important one from the point of view of cost.

Highway Program in North Dakota Calls for $1,750,000 Expenditure

North Dakota highway construction to the extent of $1,750,000 is proposed in 1923, according to a statement made by W. G. Black, recently appointed state engineer. Half of this amount, however, will be furnished by the United States government, in its dollar-for-dollar program.

The program for 1923 road construction by the state embraces only one and one-half miles of concrete surfaced road; 200 miles of gravel surfacing and 400 miles of earth road graded and drained.

It is pointed out by Mr. Black that the state, as such does not pay the other half of the amount of its road program, but in fact, only $150,000. The balance of the half, $725,000, is expected to be paid by the counties.

Mr. Black has stated that the state will allot to the counties the sum of $220,000 for road maintenance, under jurisdiction of the special road maintenance fund, annual quotas of which are expended under supervision of the State Highway commission.

The general concensus of opinion among state highway experts is that not more than $800 a mile annually should be spent for maintenance on any road. Several point out that where traffic exceeds 1,000 or 1,200 vehicles a day, possible savings on maintenance and gasoline consumption will pay the whole cost of paving with interest in from 12 to 15 years.

Bill Providing for Election of County Highway Commissioners in Wisconsin Beaten

Bill No. 219 A., introduced in the Wisconsin assembly providing that county highway commissioners should be elected by a direct vote of the people, at the same time as the election of the county school superintendent has been beaten. The commissioners are now selected by the county boards. The assembly highway committee reported in favor of the indefinite postponement of the bill. When the bill came up for action in the assembly it was defeated by a vote of 58 to 31, with 11 members absent.

Gov. Sweet Names New Member to Colorado Highway Advisory Board

John A. Donovan, of Longmont, will become a member of the state highway advisory board in May. He was appointed by Governor William E. Sweet as the member from the sixth district, represented at present by H. A. Edmonds, of Fort Collins. Mr. Edmonds' term will expire in May and Mr. Donovan was appointed to take his place.

Mr. Donovan has been a resident of Longmont for a number of year. He is engaged in the wholesale lumber business. Mr. Donovan's appointment will necessitate a reorganization of the advisory board. Mr. Edmonds is chairman of the board and the election of a new chairman will become necessary. George L. L. Gann, of Pueblo, is the present vice chairman.

Wisconsin to Investigate Cement Plant

The state assembly of Wisconsin has passed the Nelson bill providing for the appointment of a legislative committee to investigate the feasibility of establishing a state cement plant. The bill provides an appropriation of $30,000 for the investigation and $40,000 for obtaining an option on a site.

The committee will report at the 1925 session of the legislature.

Arkansas Has High Gas Tax

A highway financing bill introduced in the Arkansas legislature provides for a tax of 4 cents a gallon on gasoline, a tax on automobiles of 12 cents per horsepower, and 55 cents per 100 pounds gross weight, a tax on trucks ranging from $25 to $500, and on motorcycles, $10 flat. The minimum tax for automobiles would be $15.

Maintenance Cost of Surfaces in Kentucky Published by Highway Department

The records of the Maintenance Department of the Kentucky State Highway Department for the calendar year 1922 show that there is really considerable difference between the cost of maintaining various types of surfacing.

What are known as high type or hard surfaces, such as cement, concrete, rock asphalt and brick, show a decidedly less cost to keep in repair than do low type surfaces, such as gravel and waterbound macadam surface treated. The average cost in dollars and cents during the calendar year for the types of surfaces mentioned is as follows:

Brick	$29.95 per mile
Rock asphalt	98.70 per mile
Concrete	179.00 per mile
Gravel	296.00 per mile
Waterbound macadam surface treated	344.09 per mile

As can be seen from the table the cost of maintaining a brick surface for one year was only $29.95, while that of maintaining rock asphalt was somewhat higher, but easily within what might be called a nominal price. The amount paid for maintaining cement concrete is considerably higher than that for maintaining rock asphalt, but this is due largely to the expense entailed in filling cracks with bituminous binder, the very large part of which expense is chargeable to the first section of cement concrete surfacing laid under the supervision of this department. No reinforcements or expansion joints were used in it, so that numerous cracks, both longitudinal and transverse, have developed. In order to prevent excessive wear along the lines of the cracks and also to keep the sub-grade dry, it becomes necessary to fill them with bitumen.

When compared to the average cost of maintaining gravel and waterbound macadam surface treated, even the high figure of $179 is $120 lower per mile than the charge against gravel surface, and $170 lower than waterbound macadam surface treated. It is believed that the figure of $344.09 for waterbound macadam surface treated may be too high and that after a series of years, it will be found that for this type of surface, the maintenance charge is as low or lower than for gravel surface. These figures are averages and as such they can tell nothing of the marginal situations where a waterbound macadam surface treated has become overloaded with heavy concentrated traffic that is breaking it down so rapidly that the cost of maintenance amounts to six or seven hundred dollars per mile.

Indiana Contractors Must Complete Present Contract Before 1924 Awards Are Made

Contractors building roads for the Indiana State Highway Commission this year must complete their contracts if they expect to receive consideration when the commission awards the 1924 paving projects. Failure to complete 1923 work will be an indication they are not the best bidders in a true sense, and may prevent some from obtaining contracts next year. This position has been taken by the commission, because the commission is determined to carry out the three year construction program recently approved by Governor McCray, and possible through a gasoline tax and increased motor license fees.

"Indiana is going to have a completed system of main market highways not only leading across the state but facilitating interstate and transcontinental traffic by the end of 1925, and the commission does not propose to be delayed by failure of a contractor to complete his work within the specified time," states Mr. Williams, director of the commission.

Following a conference of the Governor, members of the commission and engineers, C. Gray, chief engineer and in charge of road construction, has sent letters to contractors of several states who regularly bid on Indiana state road paving. Mr. Gray urged contractors to store all of the cement and aggregates possible in addition to the amount that is regularly required with each contract award. The advisability of this is unquestioned, Mr. Gray points out, for with materials stored in advance, a tie-up of rail transportation, shut down of quarry, pit or mill, will not retard continuance of pavement work. This course was taken first last year by the commission and as a result practically the entire 1922 hard surfacing program was completed on time. Some states with vastly larger programs completed only a small per cent of mileage contracted, because of failure of contractors to obtain materials.

Under the three year paving program of Governor McCray and the commission, 153 miles will be surfaced this year; 405 miles in 1924; and 400 miles in 1925. Paving will be on the main roads leading direct to the market cities and terminals, and it is proposed at the end of this period that Indiana have approximately 1300 miles of hard surface highways.

Pavement Cost in Ottawa

Cost data kept by the Engineering Department of the city of Ottawa last year on asphalt pavements constructed by day labor are as follows:

Pavements of 6-in. concrete base, 1½-in. binder, 1½-in. asphalt.

	Per Sq. Yd.
Excavation and grading	.51
Sand 267 cu. yd.	.09
Cement, 1760 bags	.42
Concreting, mix and lay	.26
Stone, 663 tons R. of C.	.43
Asphalt, 505 dumps	.39
Binder, 420 dumps	.23
Laying top	.09
Laying binder	.05
Hauling top	.08
Hauling binder	.05
Coal, wood, gas, stone dust..	.01
Gutters, labor and material..	.09

The above figures do not include overhead interest or depreciation on plant charges.

It is interesting to note that the lowest contract price received by tender during 1922 was $3.28 per sq. yd. This price includes the guaranteeing of the pavement for 5 years.

Cost data kept on resurfacing old pavements are as follows:

Surface 1½-in. binder, 1½-in. top.

	Per Sq. Yd.
Grading	.09
Binder	.07
Asphalt	.34
Laying binder	.03
Laying asphalt	.11
Hauling binder	.02
Hauling asphalt	.08
Total	.74

England Taxes Gasoline 8 cents a Gallon

Those who object to a tax of 2 cents a gallon on gasoline used in motor vehicles, the funds to be used for road work, should hearken to what is being done in England in this respect. The motor manufacturers and automobile owners are demanding the abolition of the license tax based on horse power and asking that there be substituted therefor a tax of 10 cents per gallon on gasoline, with a nominal fee for registration.

A tax of 10 cents a gallon in England would mean 8 cents a gallon in this country. The following is from a communication from an English source appearing in the Engineering News Record:

Some years ago it was agreed between the central government and the gasoline vehicle user that the annual taxation to be paid by the latter should be about $50,000,000 to $55,000,000 per annum. The tax is now levied on all motor cycles, cars, taxis and trucks on a basis of horse power of the vehicle and amount to about $5 per horse power per annum.

The motor manufacturers and users associations are now pressing for the abolition of the horse-power tax and the substitution therefore of a tax of ten cents per gallon on gasoline with an additional purely nominal fee for the registration of each vehicle. This change they claim will not reduce the gross amount received and will be much fairer in its incidence than the present tax.

Plans for Paving of Colorado Roads Under Way

Plans and specifications are being prepared for another stretch of concrete pavement on the Denver-Leadville road, via Morrison, Bailey's, Jefferson, Kenosha Pass and Fairplay. The part of the road to be paved is in Jefferson County and will connect the present stretch of concrete out of Denver with the mile of pavement being constructed out of Morrison toward Denver.

The road, when the work is completed, will follow the present road only in spots. Most of the present road will be abandoned for what the engineers consider a better route. The road, when completed, will not pass through the high cuts, a few miles northeast of Morrison, but will run to the east and south of it.

The survey of the new route has met with the approval of the United States Bureau of Public Roads.

The C. D. Edwards Manufacturing company, of Albert Lea, Minn., has devised a new machine for clearing the highways and city streets of snow. It is a double-rotary affair propelled by an 80-horsepower engine of its own. The outfit can be quickly attached to any sort of traction. The manufacturers says that in a test it threw snow 100 feet from the rotary, much of it broken into such fine particles that it passed into the air in a sort of mist. The outfit will clean an eight-foot swath.

Pennsylvania Issues First 1923 Detour Bulletin Giving State Detours as of May 1st

The Pennsylvania State Highway Department has just issued its first 1923 detour bulletin which is accompanied by a map giving the exact location of every detour in the state. The major portion are in western Pennsylvania.

In traveling from Erie to Pittsburgh, by way of Meadville and Franklin, detours will be found north of Meadville, north of Franklin and north of Harrisville. There are also detours between New Castle and Portersville, and two between New Castle and Beaver. Between Pittsburgh and Kittanning there are two detours, and there are three detours between Kittanning and Barkleyville. Other detours are as follows:

Two detours will be found between Butler and Clarion. There are several detours in Indiana county—one between Indiana and Saltsburg; one between Indiana and Blairsville, and one on the route from Indiana to Clearfield. In Cambria county there are five detours—one south of Johnstown; one between Ebensburg and the Indiana county line; two between Ebensburg and Cherry Tree, and one near Patton.

Other western Pennsylvania detours will be found north of Warren; between Bradford and Smethport; between Coudersport and Port Allegany. On the Susquehanna Trail there is a detour from Selinsgrove to Liverpool. This is 45 miles in length, extending from Selinsgrove to Mount Pleasant Mills, Cocolamus, Thompsontown and Millerstown to Liverpool. There are detours on the direct road between Harrisburg and York. On the route from Trout Run through Canton and Troy to Elmira there are two detours. Between Sunbury and Wilkes-Barre there are two detours—one north of Bloomsburg and one near Shickshinny. There is a detour between Stroudsburg and Bangor on the Lackawanna Trail.

Oil Schedule

The oiling schedule for the week ending May 12 is as follows:

Lincoln Highway—Between New Oxford and Abbottstown; McConnellsburg and Fort Loudon; Greensburg and Ligonier.

William Penn Highway—Between Cresson and Duncansville; Lewistown and a point 7 miles north; Paxtang and Hummelstown; Sinking Springs borough; Wyomissing and West Lawn; West Reading borough; Douglasville and Pottstown; Pottstown and Limerick; Allentown and Wescoesville.

Lackawanna Trail—Between Delaware Water Gap borough; Easton and Martins Creek; East Bangor and Portland.

National Pike—Between Washington and Scenery Hill; Uniontown and Somerfield.

Alleghany County—Between Freeport and Brackenridge; Clinton and Beaver county line.

Armstrong County — Between Apollo and Spring Church; Leechburg and Kittanning; Avonmore and Maysville; in Leechburg Borough.

Berks County—Between Reading and Pottstown; Reading and Adamstown; in Friedenville Village.

Bucks County — Perkasie and Blooming Glen; Newton and Morrisville; in Newtown borough; Eureka and Chalfont; Yardley and Morrisville.

Butler County—Butler and Portersville; Butler and Chicora; Valencia and Butler.

Chester County—West Chester and Downingtown; Birdsboro and Pottstown; Tanguy and Sugartown; Oxford and Russellville; Parkesburg and Compassville.

Cumberland County—Carlisle and Mt. Holly Springs.

Delaware County—Aronimink and Highland Park.

Erie County—Waterford and Union City; Corry and New York State line.

Franklin County — Chambersburg and Greencastle; Waynesboro and Greencastle.

Fulton County — McConnellsburg and Knobsville.

Indiana County—Indiana and Homer City; Blacklick and Blairsville; Indiana and Jacksonville; Indiana and Penn Run; Indiana and Ernest.

Lancaster County—Lancaster and Millersville; Blue Ball and Ephrata; Lebanon county line and Lancaster county line; Quarryville and Christiana.

Lackawanna County — In Glenburne borough; Clarks Summit and Schultzville.

Lawrence County—New Castle and New Wilmington.

Lebanon County—Cornwall and Lebanon county line.

Monroe County—Stroudsburg and Bushkill; Stroudsburg and Analomink; Mountain House and Mt. Pocono.

Northampton County—Easton and Stockertown.

Pike County—Bushkill and Milford.

Schuylkill County — Girardville and Ashland; Pottsville and St. Clair.

Washington County—Washington and Canonsburg.

Westmoreland County — Greensburg and New Alexandria; Greensburg and Arona.

York County—Hanover and Maryland state line; Zion View and North York; York Haven and Newberry.

Roads Under Construction and Detours in Connecticut as of May 1, 1923

New Britain-Plainville, concrete road, one side at time. Open to traffic.

Plainville - Southington, concrete road, one side at time. Open to traffic.

Rocky Hill - From Wethersfield Town line to Cromwell Town line, concrete being laid. Open to traffic.

East Haddam, Town street under construction. Open to traffic.

Essex-North Main street under construction. Open to traffic.

East Hartford-Manchester, Silver Lane, under construction. Open to traffic. Through traffic from Hartford to Manchester should use main road.

Coventry-Willimantic Road under construction. Good detour on parallel road.

Stafford-Monson road under construction. Open to traffic.

Middletown-Cromwell-Little River Bridge under construction. Old bridge can be used.

Colebrook-Colebrook River Road. Open to traffic, shoulders incomplete.

Cornwall-Cornwall Hollow Road, construction work progressing. No detours.

New Hartford-Nepaug Road, no detours. Work practically finished.

Torrington-Litchfield. Work in progress. No detours. When concrete being laid, one way traffic will be maintained.

Thomaston-Waterbury Road, construction work under way. No detours. One way traffic will be maintained when concrete laid.

Westport-Shore road under construction, no detour.

Norwalk-Section of Post road west of Armory Hill, under construction, no detour.

Trumbull-Bridgeport to Trumbull railroad sta. under construction, no detour. Long Hill road under construction, no detour.

West Haven-Campbell avenue, under construction, no detour.

Bethany-Naugatuck, road under construction, no detour.

Naugatuck-South Main street, under construction, no detour.

Guilford-Durham-Guilford road under construction, no detour. Section of Post road from Branford-Guilford town line to West River; under construction, no detour.

Branford Section of Post road beginning just east of Branford to Branford-Guilford town line, under construction, no detour.

Hamden-State street under construction, no detour.

Stratford to New York State line, work will soon be started for about four miles road.

HIGHWAY CONTRACT NEWS

NORTH DAKOTA

Bids for gravelling on the following described State Highway projects will be received by the State Highway Commission and the Board of County Commissioners at the Court House at Forman, N. D., until May 12, 1923. Contemplated work consists of the following: Federal Aid Project No. 15, (near Forman) 2 miles gravel surfacing involving approximately 2 miles constructing earth shoulders, and the placing of 2,741 cubic yards of gravel, (loose measure).

Bids for the construction of a state highway south of Pekin will be received by the State Highway Commission and Board of County Commissioners at the Court House at Lakota, N. D., until May 16, 1923. Contemplated work consists of 9.147 miles of earth road improvement involving approximately 99,303 cu. yds. earth excavation, 1,800 cu. yds. rock excavation, 250,531 cu. yds. stas. overhaul, 1,685 cu. yds. riprap, 3,384 lin. ft. wire rope guard rail, 347 wood guard posts, 2,328 lin. ft. snow fence, furnishing and delivering and hauling and installing either corrugated metal or reinforced concrete pipe culverts as follows: 1,770 lin. ft. 18 in. diam., 240 lin. ft. 24 in. diam., 134 lin. ft. 30 in. diam., 288.33 cu. yd. Class A concrete, 25,950 lb. metal reinforcement, 89,250 lb. structural steel, 192 cu. yd. dry structural excavation, 65 cu. yd. wet.

Bids for the construction of a state highway Minot north will be received by the State Highway Commission and Board of County Commissioners at the Court House at Minot, N. D., until May 17, 1923. Contemplated work consists of 9.111 miles of earth road improvement involving approximately 67,463 cu. yd. earth excavation, 2,848 cu. yds. rock excavation, 22,445 cu. yds. stas. overhaul, 10 cu. yds. riprap, 43.30 sq. yds. cobble gutter (sand joints) 3,650 lin. ft. wire rope guard rail, 94 wood guard posts, 2,128 lin. ft. snow fence, furnishing and delivering, hauling and installing either metal pipe or reinforced concrete pipe culverts as follows:—1,726 lin. ft. 18 in. diam., 208 lin. ft. 24 in. diam., 88 lin. ft. 30 in. diam., 56 lin. ft. 36 in. diam., 84.83 cu. yd. Class A concrete, 5,886 lb. metal reinforcement, 90 cu. yd. dry structural excavation, 30 cu. yd. wet structural excavation.

Bids for the construction of a state highway south of Lakota will be received by the State Highway Commission and Board of County Commissioners at the Court House at Lakota, N. D., until May 16, 1923. Contemplated work consists of 17,739 miles of earth road improvement involving approximately 17.5 acres clearing and grubbing, 8.5 acres plowing and harrowing, 125,511 cu. yds. earth excavation, 5,200 cu. yds. rock excavation, 1,350 cu. yds. stas. overhaul, 245 cu. yds. riprap, 7,800 lin. ft. wire rope guard rail, 200 wood guard posts, 2,736 lin. ft. snow fence, furnishing and delivering, hauling and installing either metal pipe or reinforced concrete culverts as follows: 3,166 lin. ft. 18 in. diam., 358 lin. ft. 24 in. diam., 28 lin. ft. 30 in. diam., 222.85 cu. yds. Class A concrete, 15,240 lbs. metal reinforcement, 170 cu. yds. dry structural excavation.

Bids for the construction of a state highway from Danzig north and west will be received by the State Highway Commission and Board of County Commissioners at the Court House at Ashley, N. D., until May 14, 1923. Contemplated work consists of 17.402 miles of earth road improvement involving approximately 123,762 cu. yds. earth excavation, 5,092 cu. yds. rock excavation, 93,785 cu. yds. stas. overhaul, 810 sq. yds. cobble gutter, 3,990 lin. ft. wire rope guard rail, 190 wood guard posts, 2,772 lin. ft. snow fence, hauling and installing and furnishing and delivering either metal pipe or reinforced concrete culverts as follows: 1,990 lin. ft. 18 in. diam., 412 lin. ft. 24 in. diam., 395.79 cu. yds. Class A concrete, 30,488 lbs. metal reinforcement, 288 cu. yds. dry structural excavation, 25 cu. yds. wet structural excavation.

Bids for the construction of a state highway from Berthold to Des Lacs will be received by the State Highway Commission and Board of County Commissioners at the Court House at Minot, N. D., until May 17, 1923. Contemplated work consists of 8.196 miles of earth road improvement involving approximately 60,346 cu. yds. earth excavation, 2,510 cu. yds. rock excavation, 272 cu. yds. stas. overhaul, 65 cu. yds. riprap, 155 sq. yd. cobble gutter, 1,220 lin. ft. wire rope guard rail, 160 wood guard posts, 176 lin. ft. snow fence, furnishing and delivering, hauling and installing either metal pipe or reinforced concrete as follows: 2,444 lin. ft. 18 in. diam., 72 lin. ft. 24 in. diam., 114 lin. ft. 36 in. diam., 84.18 cu. yds. Class A concrete, 12,406 lbs. metal reinforcement, 35 cu. yds. dry structural excavation.

Bids for the construction of a state highway will be received by the State Highway Commission and Board of County Commissioners at the Court House at Minot, N. D., until May 17, 1923. Contemplated work consists of 18.441 miles of earth road improvement involving approximately 9.2 acres clearing and grubbing, 9.2 acres plowing and harrowing, 153,430 cu. yds. earth excavation, 14,212 cu. yds. rock excavation, 12,148 cu. yds. stas. overhaul, 93 cu. yds. riprap, 112 sq. yds. cobble gutter, 12,920 lin. ft. wire rope guard rail, 258 wood guard posts, 1,424 lin. ft. snow fence, furnishing and delivering, hauling and installing either corrugated metal or reinforced concrete pipe culverts as follows: 2,582 lin. ft. 18 in. diam., 986 lin. ft. 24 in. diam., 996 lin. ft. 30 in. diam., 272 lin. ft. 36 in. diam., 891.16 cu. yds. Class A concrete, 72,893 lbs. metal reinforcement, 873 cu. yds. dry structural excavation, 50 cu. yds. wet structural excavation, 870 lin. ft. timber piles.

TEXAS

Bids for the improvement of certain highways in Palo Pinto County, will be received at the office of E. L. Pitts, County Judge, at Palo Pinto, Texas, until May 15, 1923. Work to be done involves construction of 5.81 miles of crushed stone road and necessary drainage structures, and following approximate quantities. 46.46 acres clearing, 19,031.7 cu. yds. earth roadway excavation, 37,132.7 cu. yds. earth borrow excavation, 15,686.2 cu. yds. earth overhaul, 1,647 cu. yds. loose rock excavation, 3,558.1 cu. yds. solid rock excavation, 10,232.31 cu. yds. sledged stone hauled 1st ¼ mi., 10,232.31 cu. yds. crushed stone hauled 1st ¼ mi., 84,072 lbs. reinforcing steel, 3,748 lin. ft. wooden guard fence, 863.89 cu. yds. concrete 1:2:4 mix., 348 lin. ft. concrete bridge rail (type C).

Bids for the improvement of certain highways in Palo Pinto County, will be received at the office of E. L. Pitts, County Judge, at Palo Pinto, Texas, until May 15th, 1923. Work to be done involves construction of 9.81 miles crushed stone road and necessary gradng and drainage structures and following approximate quantities. 71.84 acres clearing, 31,612.5 cu. yds. earth roadway excavation, 14,677.2 cu. yds. loose rock excavation, 8,753.8 cu. yds. solid rock excavation, 15,431.55 cu. yds. sledged stone hauled 1st ¼ mi., 10,285.46 cu. yds. crushed stone hauled 1st ¼ mi., 268,211 lbs. reinforcing steel, 9,450 lin. ft. wooden guard fence, 2,095.86 cu. yds. concrete 1:2:4 mix., 1,064 lin. ft. concrete bridge rail (Type C).

Bids for the improvement of certain highways in Uvalde County, will be received at the office of the County Judge, Hon. H. C. King, at Uvalde, Texas, until May 15th, 1923, and then publicly opened and read. Work to be done involves: 7.06 acres clearing; 28,560.2 cu. yds. earth roadway excavation, 1,224.6 cu. yds. solid rock excavation, 15,071.4 cu. yds.

GOOD ROADS
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Frequent Reorganization of State Highway Departments Costly, Says Good Roads Board

Highway departments of fourteen States have either been re-organized or the management of their affairs are under new direction as the result of the action of the Legislatures or a change in the state administration, according to the study of State Highway activities being made by the Good Roads Board of the American Automobile Association. This big turnover in management of state highway departments does not take in consideration the changes which occurred during 1922 and the years preceding, but represents the legislative or political product of three and a half months of 1923. When it is considered that these departments have the expenditure of from $2,000,000 to $40,000,000 annually under their direction, the economic loss resulting from the frequent changes in administration with the corresponding changes in policy is appalling, points out H. G. Shirley, Chairman of the Good Roads Board of the American Automobile Association.

The Good Roads Board recognizes that changes in personnel and plan of administration of State Highway Departments are sometimes advisable just as changes are advisable in private business, said Mr. Shirley. Any changes made, argues the Good Roads Board, should be made on sound business principles looking to the highest efficiency and economy of administration rather than through political expediency, as seem to be indicated in the record of some of the recent turnovers in state highway administration.

The changes made in the State Highway departments in 1923 vary from the usual change of the chief executive of the Department with the incoming administration, to a complete re-organization of a State Highway Department along entirely different lines. In one state after May 1 of this year there will be left only one assistant draftsman of the old organization. All of the heads of departments and even minor employees were asked for their resignations. In another state, widely separated from the first, the entire personnel of the directive heads of the organization were relieved from further duty by legislative enactment and a new form of administration substituted. This is the second complete change in four years for this state.

If a corresponding high percentage of private business concerns of similar magnitude were subjected to a like turnover in management, Mr. Shirley declares, the results would be so disastrous to business generally as to demand on the part of business the immediate remedy of this situation. It is pointed out that business concerns having the expenditure of amounts as large as those entrusted to State Highway Departments, for reasons of economy and efficiency, must plan their work ahead for a period of five, ten and twenty years. The difficulties in applying this well known rule of business to the administration of a State Highway Department will be appreciated when fourteen out of forty-eight states changed either personnel or plan of administration or usually both in three months. The average term of office of a state highway executive is two and a half years, according to the statement of a well known state highway official.

The observations which have been made by the Good Roads Board of the American Automobile Association emphasize the necessity of close cooperation between the motorist who is interested in highway improvement and the state highway departments. It is the opinion of Chairman Shirley that the frequent changes in personnel and plan of administration is largely due to lack of understanding on the part of the public of the plans of the department and just how the state's money is being expended for construction and maintenance of highways. It is the belief of the Board that the motorists through the organized effort of their clubs can materially help in building up public confidence in their State Highway Department.

February Wages for Common Road Labor Same as 1922

Wages of common labor for road work in February were practically the same as for the same month in 1922, according to the U. S. Bureau of Public Roads.

Averaged for groups of states the price per hour was as follows: New England, 48 cents; Middle Atlantic, 40 cents; East North Central, 34 cents; West North Central, 29 cents; South Atlantic, 21 cents; East South Central, 19 cents; West South Central, 24 cents; Mountain, 38 cents; and Pacific, 47 cents. In some of these sections the figures are based on a small amount of work due to the season of the year.

The price per hour for other classes was as follows: Superintendents, 79 cents to $1.11; foremen, 53 to 88 cents; truck drivers, 27 to 64 cents; roller engineers, 35 to 81 cents; mixer operators, 31 to 98 cents; steam-shovel operators, 65 to $1.19; carpenters, 43 to 76 cents; concrete finishers, 35 to 78 cents; mechanics, 30 to 61 cents; teams without drivers, 24 to 80 cents; and teams with drivers, 29 to $1.12. In almost every case the upper limit of price prevails on the Pacific slope with materially lower prices in other sections.

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Additional Road Funds for Nebraska National Forest

Expenditures totaling $3,603 of national forest highway funds to be used in the reconstruction of the Halsey Plantation road within the Nebraska National Forest have just been approved by Secretary of Agriculture Wallace. This money was made available for roads serving national forests and for roads within or adjacent to the forests which are of primary importance to States, counties, and communities.

The Halsey Plantation road is considered the most important road in the Nebraska National Forest. The expenditure of the $3,603 just approved will apply on the repair work on that section of the road extending from Halsey to Halsey Nursery.

824 Miles Federal-Aid Roads Started in February

During February, 824 miles of Federal-aid roads were placed under construction, according to the U. S. Bureau of Public Roads. This is said to be a particularly good record for a month that is considered unfavorable for road work in many of the states. The character of the work is indicated by the following table. Several of the projects included in the tabulation represent new surfaces laid on an old road as a base.

	Miles.	Estimated Cost.
Graded and drained	147.9	$1,847,049
Sand-clay	141.6	765,831
Gravel	289.4	3,493,325
Water-bound macadam	42.4	697,420
Bituminous macadam	46.1	1,462,855
Bituminous concrete	19.5	580,861
Cement concrete	127.5	4,293,320
Brick	8.4	330,160
Bridges	1.6	361,219

New Financial Statement Adopted by A. G. C. Now Available for Distribution

The A. G. C. form of financial statement, which was presented by the Committee on Methods in its annual report to the Convention in Los Angeles, is now ready for distribution. The new form, consisting of a summary statement of assets and liabilities, with supplementary exhibit sheets, for loose leaf binding, is contained in an attractive A. G. C. folder. Headquarters has received many orders for this document, which is being rapidly adopted by construction companies as a clear and concise method of showing their financial condition to bankers or other interested persons. It has been favorably commented on by many bankers and will undoubtedly serve the contractors' needs more adequately than the forms heretofore commonly used. Copies may be obtained from A. G. C. headquarters, 1038 Munsey Building, Washington, D. C., at 25 cents each for the entire folder, or 10 cents each for the summary sheets.

Expenditures totaling $28,576 of national forest highway funds and $71,424 from other Federal road funds for the construction of 19 miles of roads in North Carolina have just been approved by Secretary of Agriculture Wallace. The national forest highway fund was made available for roads serving the national forests and for roads within or adjacent to the forests which are of primary importance to States, counties and communities.

Yance County, North Carolina, has offered $30,000 and McDowell County $105,000 for use in constructing the highway which is an important section of the Marion-Micaville road connecting the county seat towns of these two counties. The State of North Carolina has offered funds to complete the road building project, estimated to be around $216,843.

The road in question is entirely within the Pisgah National Forest and runs in a northwesterly direction from Garden City in McDowell county. It is planned to let bids and start construction this year.

Program of Hamilton Meeting of Canadian Good Roads Association is Announced

The modification by the Federal Government of its attitude regarding federal aid in highway construction, to the extent of providing for an extension of two years of the time within which the various provinces may earn and be paid the sums allotted them under the Federal Highway Act, will give to the delegates attending the Tenth annual convention of the Canadian Good Roads Association on June 11, 12, 13 and 14 next at Hamilton an opportunity to discuss fully the question of federal aid. Despite the attitude taken by the Government, all the provinces are unitedly in favor of it, and one of the subjects on the tentative programme of the convention which has just been prepared by the executive is entitled "Who shall pay for the roads?" This discussion will not only embrace suggestions for the equitable distribution of the cost but also the question of federal participation in highway construction. The result will probably be that some strong action will be taken to support those who are fighting for a new grant from the Dominion treasury.

The tentative program that has been prepared for the convention indicates that while every phase of highway construction is covered, emphasis is being laid this year on the problem of maintenance, this being a matter that has had to be seriously studied by the provincial governments, who have found that heavy expenditures in construction are being lost through lack of proper maintenance. The subject will be divided into two heads, one dealing with permanent types of roads, with which will be associated cost data that will be invaluable for reference purposes and the other with the best methods of maintaining roads, particularly earth and gravel roads.

Tourist traffic will be another subject down for discussion, as well as the utility of single track cement concrete roads, bituminous surfaces, methods for reconstructing old macadam roads, the merits of metal and other types of culverts; the use of refined tar in road construction and maintenance; together with a talk on contractors and their worries.

Two official drives will be undertaken during the convention to give the delegates an opportunity of inspecting various types of roadway. On the Monday afternoon a drive of sixty miles will embrace Galt, Guelph and Kitchener, and will cover roads of cement concrete, heavy bituminous construction, graded gravel and asphaltic concrete. On the Thursday afternoon the drive will be to Niagara Falls, Queenstown and Brock's Monument, the delegates not only being able to inspect a seven years old penetration asphaltic concrete, in addition to other types of pavement including cement concrete on grade, and some very fine gravel roads, but will also see the great hydro development in that district.

The annual dinner will be held at the Royal Connaught Hotel, the headquarters of the convention, on Wednesday evening. The Lieutenant Governor of Ontario, the Hon. Harry Cockshutt, has been invited by the president of the Canadian Good Roads

Pennsylvania Road Development Requires $28,000,000 a Year, States Highway Commission Report

Paul D. Wright, State Highway Commissioner of Pennsylvania, has informed members of the Roads Committee of the Pensylvania House of Representatives that the State Highway Department during the next two years will require $56,200,000, or at the rate of over $28,000,000 per year, properly to perform the necessary road maintenance work in Pennsylvania. The figures of the Highway Commissioner are based on a program of estimated expenditures per year for a number of years to come.

"It is the policy of the department, under the present administration, to give business-like consideration to the maintenance feature of its work, with the belief that whether or not there is money for construction work roads should be given a character of maintenance that will properly preserve hard-surfaced highways and put earth roads in as travelable condition as their character will permit," said the Highway Commissioner.

The following is a condensed statement showing the amount estimated as being necessary for maintenance work each year:

Kind of Work	Amount
General Repairs to all Classes of Roads—Earth, Stone and Durable Types	$4,000,000
Bituminous Surface Treatments for Stone Roads	1,500,000
Resurfacing Stone Roads	5,500,000
Replacement of Stone Roads (25 year program)	5,000,000
Replacing Guard Rail at Dangerous Locations (4 year program)	750,000
Widening Lincoln Highway to Relieve Dangerous Conditions	200,000
Widening Other Roads to Relieve Dangerous Conditions	350,000
Repairing and Replacing Bridges	500,000
Oiling Earth Roads	200,00
Maintenance of State-aid Roads (50% of total cost)	250,000
Overhead Charge of the Maintenance Operations	1,600,000
General Expenses of the Automobile Division	600,000
Maintenance of Equipment	400,000
Total	$20,850,000

A very important item is the $5,000,000 provided for the replacement of existing pavements when worn out. There are approximately 3000 miles of waterbound macadam on the state highway system which must be replaced with more durable types of construction during the next 25 years. This will mean replacement of 125 miles each year during this period of time, at an estimated cost of $5,000,000 per year. Replacement of wooden guard rail, originally intended for horse-drawn traffic, with the wire cable guard rail necessary to prevent automobiles from going over embankments, will cost $750,000 each year. Of particular importance are the two items totalling $550,000 for the elimination of dangerous highway conditions, through the widening of curves.

There is a Bill now before the Legislature providing for the maintenance of borough roads on the highway system; this will cost the highway department $1,750,000 annually. There has also been some discussion with respect to providing about $1,000,000 each year for State Reward for township roads, this sum to come from the receipts for motor vehicle registrations. It is customary to pay for the elimination of dangerous grade crossings from the Motor Fund. On the State Highway System there are about 12,000 grade crossings over steam railroads, the elimination of which will cost upwards of $500,000,000. In accordance with the present policy the state's share of this cost approximates $200,000,000. A conservative program of grade crossing elimination will require $1,500,000 annually for this purpose.

While the policy of the State Highway Department is that all maintenance expenditures shall be met from motor vehicles registration receipts—and the funds for new construction provided from bond issues, or other sources, it will be necessary during the next two years, because of the financial condition of the Commonwealth, to use motor vehicle funds to meet the Federal Aid appropriation amounting to about $5,000,000. This will require $3,000,000 a year, unless the bond issue of $50,000,000 is made available in 1924, in which case Federal Aid expenditures for 1924 can be met from the Bond Fund.

Adding these additional items to the total mentioned in the tabulation shown above will give the following total for a justified maintenance program for each of the next two years:

Total from Above	$20,850,000
Maintenance of Borough Roads on the State Highway System (90%)	1,750,000
Township Reward	1,000,000
Elimination of Grade Crossings	1,500,000
	$25,100,000
To meet Federal Aid if not available from Bond Fund	3,000,000
	$28,100,000

The Department's ideas regarding maintenance of highways, Mr. Wright told members of the Legislature, are simply in line with its determination to give Pennsylvania the best highway system in America.

Association, the Hon. J. L. Perron, to formally open the convention on June 11 and a distinguished list of guests are also being invited. The Engineering Bureau of Standards, who have appointed several sub-committees in connection with the standardizing of traffic signals on highways will probably hold their next conference at Hamilton at the same time as the convention.

North Carolina Builds Cheaper Roads

The North Carolina State Highway Commission recently let new road contracts amounting to $3,030,099. Bids were submitted by 165 different firms of road contractors. There were twenty-one projects totalling 193.67 miles of which 63.68 miles were mostly of asphalt paving and cost $1,933,937, or $30,370 per mile, including grading, draining, bridges and culverts. The widths of the pavement were about equally divided between 16 and 18 feet. The remaining 129.99 miles were of sand clay top soil or earth, costing $1,076,290 or $8,279 per mile. Over 200 miles of asphalt roads were contracted for in North Carolina last year.

Big Gain in Asphalt Streets and Roads

According to an announcement by J. E. Pennybacker, secretary of the Asphalt Association, New York, a total of 82,700,000 square yards of asphalt paving were laid upon American roads and streets last year. This is equivalent to 7,831 miles of highways, 18 ft. wide, and sufficient to build an asphalt road 18 ft. wide from Augusta, Me., to San Francisco, Cal., thence to New Orleans, La., and north to New York. It represents an increase of 14,000,000 square yards over the yardage laid in 1921. Last year was a record breaking year, especially in asphaltic concrete construction on the Pacific coast, the construction of that type of road in that territory alone amounting to 49,250,000 sq. ft. compared with 40,000,000 sq. ft. in 1921 and 28,000,000 in 1920. The gains in asphaltic concrete surfacing on various types of bases and in asphalt and oil macadam pavements are even greater. The total area of pavements laid in 1922 in which asphalt was used on the Pacific coast amounts to 108,000,019 sq. ft.—equivalent to 1290 miles of 16 ft. highway.

Wages to be paid on the county road work in Ida county, Iowa, of which Ida Grove is the county seat, have been fixed as follows by the board of supervisors: Wages for men and team are fixed at 55 cents per hour, men alone 45 cents an hour, teams alone, 25 cents an hour. The concrete bridge foreman is to be paid 60 cents per hour and the assistant bridge foreman, 50 cents per hour. The grader men will be paid 70 cents per hour and the engine men 70 cents per hour. No mileage will be paid and time will be given on one way only. The rate for dragging will be 80 cents per mile round trip. Truck drivers will be paid $100 per month.

Universal Portland Cement To Be Sold by Sack

Beginning June 1, 1923, the Universal Portland Cement Co. will sell its product invoiced by the sack instead of by the barrel. On cement sold prior to that date, the price per sack will be determined by dividing by four the price per barrel. On quotations and sales made on and after June 1, the price will be figured by the sack.

This change is made only after sending an inquiry to thousands of cement buyers, including dealers, contractors, architects and engineers, large industrial concerns and others. The replies were overwhelmingly in favor of the change.

North Dakota Good Roads Association to Urge Highway Development

The North Dakota Good Roads Association will begin a campaign of expansion and initiation into law through vote at the June, 1924, primaries of the legislative program which failed in the recent legislative session.

Good roads meetings will be held throughout the state as a part of the plan of operation. The association also will go into politics, president I. J. Moe recently declared, and legislative candidates will be questioned as to their stand upon highways legislation.

Officers of the association are as follows: President, I. J. Moe, Valley City; first vice-president, P. O. Thorson, Grand Forks; second vice-president, C. E. Danielson, Minot; treasurer, J. L. Bell, Bismarck; member at large of the executive committee, Peter Berringer, Dickinson; chairman of the legislative committee, A. T. Kraabel, Clifford.

The Chausse Oil Burner Company has been incorporated in Michigan to manufacture oil burning apparatus for asphalt street repairing, for installation in electric railway cars, for production of house furnace burners and the manufacture of oil burning hand torches. The company is incorporated for $100,000 and its officers are W. McK. White, president; W. G. Chausse, vice-president; Wray P. White, secretary, and offices have been opened at 206 Lincoln Building, Detroit. Plans are being made for the location of a factory either in Detroit or a nearby city. The apparatus which the Chausse company will make has been produced in a small way for several years for use by steam and electric railways, street paving contractors and municipal boards of work. The three gallon Chausse torch has been a standard in steam railway signal departments for several years in use for thawing switches and signal mechanism.

Portland Cement Production in April 23% Higher Than Year Ago

Production of portland cement in April was over 11,350,000 barrels according to figures just compiled by the United States Geological Survey. This represents an increase of more than 2,000,000 barrels, or approximately 23 per cent over last year's April production and is the largest quantity ever manufactured during that month. Production for the first four months of this year exceeded 37,000,000 barrels as compared with about 27,000,000 barrels in 1920, the best previous record for that period.

April shipments of cement from the mills were also unusually heavy for this season of the year and nearly reached the 13,000,000 barrel mark—an increase of 50 per cent over April, 1922. For the first four months of 1923, shipments exceeded 34,600,000 barrels as compared with 22,700,000 barrels, the 1919-1923 five years average for the period.

Stocks of finished cement in manufacturers' hands at the end of April this year were 11,450,000 barrels as compared with an average of about 12,200,000 barrels for the five-year period 1919-1923. Taking into consideration the unprecedented early season demand which, since January 1, has absorbed over 12,000,000 barrels more than ever before, manufacturers have made a remarkable record in keeping pace with the situation.

PRODUCTION, SHIPMENTS AND STOCKS OF PORTLAND CEMENT APRIL, 1923
Compiled by United States Geological Survey

	Producing Districts as shown in Statistical Reports of United States Geological Survey	Number of Mills	Cement Production APRIL			Cement Shipments APRIL			STOCKS at end of APRIL		
			1923	1922	1921	1923	1922	1921	1923	1922	1921
1	Eastern Pennsylvania, New Jersey and Maryland	22	2,996	2,568	2,326	3,554	2,529	2,135	3,778	4,306	2,078
2	New York	9	514	434	525	624	470	414	804	1,000	828
3	Ohio, Western Pennsylvania and West Virginia	10	1,145	801	776	1,247	701	710	1,042	1,396	1,147
4	Michigan	12	551	476	515	598	420	460	624	812	661
5	Illinois, Indiana and Kentucky	10	1,924	1,398	1,340	2,405	2,228	1,236	1,304	2,542	2,651
6	Virginia, Tennessee, Alabama and Georgia	8	573	566	460	635	535	390	213	518	456
7	Eastern Missouri, Iowa and Minnesota	9	1,018	1,055	848	1,197	781	795	1,692	1,834	1,726
8	Western Missouri, Nebraska, Kansas and Oklahoma	11	855	526	561	940	554	566	884	856	717
9	Texas	5	360	290	259	347	278	227	285	344	265
10	Colorado and Utah	5	245	173	145	218	161	176	166	170	113
11	California	9	917	697	629	924	741	618	139	332	547
12	Oregon, Washington and Montana	8	261	259	267	265	194	192	522	360	411
	Total	118	11,359	9,243	8,651	12,954	8,592	7,919	11,450	14,470	12,600

Figures represent barrels, 000 omitted.
One barrel equals four sacks

Total Production
1922—114,790,000 bbls.
1921— 98,842,000 bbls.

Total Shipments
1922—117,701,000 bbls.
1921— 95,507,000 bbls.

Minnesota to Limit Road Bonds to Necessary Work

County reimbursement bond issues under the new 1923 law for state trunk highway improvements will be limited to necessities, the State Highway Department of Minnesota has announced. The policy is framed to prevent the taking of trunk highway funds for minor local improvements before important projects more needed to serve the greatest numbers of taxpayers are carried out. The statement from the department follows a ruling on the new law given by the attorney general and points out changes from the old reimbursement bond law. The department estimates that about $4,000,000 of new bonds will be issued, against more than $11,000,000 that would be piled up under a more liberal policy and added to the $26,000,000 now charged for payment from automobile tax receipts.

Needed Improvements First

Charles M. Babcock, state highway commissioner, after receiving the ruling from the attorney general and counseling with his engineers, announced that only bond projects to carry out needed improvements will be approved.

"Minnesota adopted a state trunk highway development plan by a 5 to 2 vote of the people," said the commissioner. "The principle is that a system of main highways be improved on a state-wide scale and without regard to county or other local lines. The department cannot sanction departures from this first principle—schemes that would put minor local improvements ahead and take state money that logically and justly should be used for more necessary betterments on more important and heavier traveled highways."

Under any other policy, it was pointed out, money needed for improvement of a highway carrying 1,000 or more vehicles a day might be diverted to an unimportant project on a section serving less than 150 vehicles daily.

Early Action Planned

The new reimbursement bond authorization subject will be taken up this week in many counties, some boards having called special meetings for that purpose. Under the old law a three-fifths vote of the board would pass $125,000 of bonds and a unanimous vote $250,000, while larger amounts could be voted at county elections. The new law simply authorizes issues up to $250,000 by a three-fifths vote of the commissioners.

The old authorization resulted in a larger percentage of paving than would have been built otherwise. This was because the commissioners, believing that other needs would be provided from regular state funds, insisted that the county bond money be used for hard-surfacing. Comparatively few paving improvements are planned under the new law.

Suggests Proper Move

The statement from the highway department invites the County Board to first decide on improvements it favors, giving the general route and termini. After approval is given, the board will proceed with right-of-way acquisition or other necessary preliminaries and with the sale of the bonds, while the state is calling for bids and awarding the contract. The law requires that all projects be under state specifications and supervision, and the county now will be relieved of all responsibility and insured specific reimbursement. Operations are to start in each instance as the bond proceeds are turned over to the state treasurer.

Any balance over the cost of the agreed undertaking, the law provides, shall be expended on other sections of trunk highways in the county within a year.

Pennsylvania Detours as of May 10th

The Pennsylvania State Highway Department announced on May 10th the following detours on main routes in Pennsylvania:

Lincoln Highway—No detours.

William Penn Highway—No detours. (Travelers on the William Penn Highway are advised not to attempt this thoroughfare west of New Alexandria. Between Blairsville and the Cambria county line there are twelve miles of old pike in only fair condition. Between Ebensburg, Cambria County, and Huntingdon the traveler should go via Loretto, Cresson, Hollidaysburg, Williamsburg and Water street. Travelers bound to Altoona may turn north at Hollidaysburg.)

Lackawanna Trail (Binghamton, N. Y., to Philadelphia)—Detours at Delaware Water Gap and at Bangor.

Harrisburg to Scranton via Wilkes-Barre—Detour between Liverpool and Selinsgrove; northeast to Bloomsburg at Shickshinny.

Corning, N. Y., to Emmittsburg, Md., via Williamsport and Harrisburg—Detour between Selinsgrove and Liverpool (this is the same detour as will be met between Harrisburg and Wilkes-Barre. It is 45 miles in length, entirely over state roads.) Travelers from Trout Run, on this route, to Olean, N. Y., via Canton and Troy, will find a detour north of Troy and south of the New York line.

Erie to Harrisburg via Clearfield—North of Meadville; north of Franklin.

Pittsburgh to Erie via Butler, Mercer and Greenville—North of Meadville.

Oiling Schedule

Centre County—Between Center Hall and Woodward; Center Hall Borough; Bellefonte and Center County line; Center Hall and Rebersburg.

Clinton County—Between Lock Haven and Jersey Shore.

Dauphin County—Between Paxtang and Hummelstown.

Lebanon County—Between Cornwall and Lancaster County line; Village of Annville; Lebanon and Myerstown.

Lancaster County—Between Lancaster County line and Brickerville; Adamstown and Akron; Adamstown Borough.

Cumberland County — Between Carlisle and Mt. Holly.

Lancaster County—Between Lancaster and Millersville.

Perry County—Between Millerstown and Liverpool.

Mifflin County—Between Milroy and Lewistown; Lewistown Borough; Burnham Borough; Lewistown Borough; Lewistown and McVeytown; McVeytown Borough.

Luzerne County—Between Hazelton and Albert.

Butler County—Between Harrisville and Greene City; Butler and Prospect; Butler and Chicora.

Venango County—Between Emlenton and Eau Claire; Lisson and Emlenton.

Berks County—Between Reading and Pottstown; Wyomissing and West Lawn; Wormlesdorf Borough; Wernersville Borough; Sinking

Springs Borough; Wyomissing Borough; Robesonia Borough; West Reading Borough; Birdsboro and Morgantown.

Schuylkill County—Between Pottsville and Girardville; Girardville and Ashland.

Lehigh County—Between Allentown and Coopersburg; Wescoesville and Allentown.

Northampton County — Between Easton and Martins Creek; Walnut Port and Lehigh Gap.

York County—Between Rossville and Lewisberry; New Park and Catchelville; Hanover and Adams County line.

Franklin County—Between Greencastle Borough; Waynesburg and Mercersburg; Greencastle Borough; Mercersburg and Skimpstown.

Adams County—Between Littlestown and York County line.

Chester County—Between Birdsboro and Pottstown; Tanguy and Sugartown; Phoenixville and Kimberton; Philadelphia and Essington; Aronnicke and Highland Park.

Montgomery County — Between King of Prussia and Devon; Limerick and Douglasville; Skippack and Belfry; Collegeville and Mont Clare; Bridgeport and Grief Mills; Skippack and Lederachville.

Bucks County—Between Perkasie and Blooming Glen; Newton and Morrisville; Newton Borough; Eureka and Chalfont; Emilie and Fallsington; Blooming Glen and Lexington; Sellersville Borough; Bristol and Hulmeville.

Armstrong County—Between Butler and Kittanning; Apollo and Spring Church; Leechburg and Kittanning; Avonmore and Maysville.

Indiana County—Between Indiana and Homer City; Black Lick and Blairsville; Indiana and Jacksonville.

Fulton County—Between McConnellsburg and Fort Loudon; Webster Mills and McConnellsburg; McConnellsburg and Bedford County line.

Huntingdon County — Between Huntingdon and Water Street.

Blair County—Between Leamersburg and Claysburg; Duncansville and Cambria County line.

Cambria County—Between Cresson and Blair County line.

Monroe County—Between Delaware Water Gap Borough; Stroudsburg and Bushkill; Stroudsburg and Analomink; Mountain Home and Mt. Pocono; East Stroudsburg Borough; Stroudsburg Borough.

Pike County—Between Bushkill and Milford.

Lackawanna County — Between Glenburg Borough; Clarks Summitt and Schultzville; Carbondale and Wayne County line.

Wayne County—Between Honesdale and Lackawanna County line.

Allegheny County—Between Clinton and Beaver County line; Elizabeth and Boston.

Westmoreland County — Between West Newton and Belle Vernon; Ligonier and Jenners; Ligonier and New Florence.

Washington County — Between Washington and Canonsburg; Washington and Prosperity; Washington and Scenery Hill; Washington and Claysville; Mead and Washington; Midway and North Star.

Fayette County—Somerfield and Uniontown; Brownsville and Uniontown; Vanderbilt and Fayette City; Vanderbilt Borough.

Lancaster County—Between Lancaster and Leaman Place.

Lycoming County—Between Williamsport and Cogan Station; Jersey Shore and Avis; Jersey Shore and Collinsville; Muncy and Montgomery; Halls and Pennsdale; Jersey Shore Borough.

Tioga County—Between Wellsboro and Covington; Wellsboro Borough.

Bradford County—Between Wyalusing and Terrytown.

Erie County — Between West Springfield and Ohio State line.

Crawford County—Between Cambridge Springs and Edinboro.

McKean County — Between Port Allegheny and Smethport.

Walter G. Black of Mandan, N. D., recently appointed state engineer, has announced the following appointments: Assistant chief engineer, C. A. Myhre, formerly of Valley City, N. D.; construction engineer, J. A. Wallace, formerly division engineer at Devils Lake, maintenance engineer, T. C. Plomasen, formerly of Beach, N. D.; chief clerk, David Lieberman.

GOOD ROADS

By Roy D. Chapin, *Vice-President,*
National Automobile Chamber of Commerce

A few years ago the sight of a man in overalls and a straw hat hard at work with the hoe was convincing evidence that he was a farmer. Store clothes bespoke the city dweller.

Times and the road have changed. Highway transport is sending the city man out to the country at the close of his day's work and bringing the farmer and his family into town. The old distinctions are passing and the cartoonist of the future will have to look to a new type for his characters.

The task now is one of developing the vast network of highways necessary to complete communication. Broad financial policies must be laid down to insure an expedited but efficient program of expenditure. Centralized control is essential in order that there may be a proper relation between the possible earning power of the road and the cost of its construction and maintenance.

The construction of highways is of benefit not alone to those of us who are paying the taxes today, but to those who will follow. If we are to have the roads in our lifetime, we must predicate our initial outlay in many instances upon serial bond issues which will give us and our children the road at a reasonable rental for its use.

Property values, whether in the city or country, are definitely affected by highway improvement and if we are to proceed soundly from a financial standpoint, the full property power of the state should be thrown behind state bond issues.

The road user should be willing to pay all of the costs of maintaining the highway, not so much as a matter of principle as because his operating costs will be directly influenced by the quality of the highway on which he is driving, and when all is said and done, the motor vehicle offers the most direct protection to the state investment in the highway, because it is an annual revenue and can be directed against an annual charge.

Any use of motor fees which deflects funds from this fundamental use is vicious and should not be countenanced.

It is also important that the country systems bear some relation to the state improvement, as otherwise the less important highway might be improved at the expense of the more important—as stated in terms of traffic—the only fair measure.

The program is so large and such large funds are at issue that we must weigh all of the factors carefully when planning any construction. Varying conditions, varying stages of development, render impossible any definite, detailed statement of policy applicable to all alike.

But the important thing is that we must not, ostrich-like, bury ourselves in the detail and so lose sight of the objective. Either the highway makes for social and economic betterment, or it is not worth while. If it stands either test, then it should be financed, constructed, maintained and operated in a manner destined to give the utmost service to the public which must pay the bill as it has to pay the bill for any other transportation service.

GOOD ROADS

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American Road Builders' Association Elects New Officers

Frank Page, Chairman of North Carolina State Highway Commission, Heads Organization for Coming Year

Announcement of the election of new officers and directors and decision by the new Board of Directors as to the time of the next convention and National Good Roads Show were the chief features of the annual meeting of the American Road Builders' Association held in New York, May 15. Reports were received from the Executive Committee, the Treasurer and the Convention Committee. The latter was accompanied by a financial statement, audited by Haskins & Sells, certified public accountants, and showed that the receipts from the sale of exhibition space were $62,824.77 and the disbursements, $56,332.81, leaving a gross profit of $6,491.96.

The new officers and directors are:

President, Frank Page, Chairman, State Highway Commission, Raleigh, N. C.; Vice-president, Northeastern district, E. L. Powers, Editor "Good Roads," New York City; Vice-president, Southern District, W. S. Keller, State Highway Engineer, Montgomery, Ala.; Vice-president, Central District, S. F. Beatty, Vice-President, Austin-Western Road Machinery Co., Chicago, Ill.; Vice-president, Western District, Samuel Hill, Hon. Life Pres. Washington State Good Roads Assn., Seattle, Wash.; Treasurer, James H. MacDonald, Consulting Road and Paving Expert, New Haven, Conn.

Directors for One Year

J. R. Draney, Sales Mgr., U. S. Asphalt Refining Co., New York City; Frank T. Sheets, Supt. of Highways, Dept. of Pub. Wks. & Bldgs., Springfield, Ill.; W. A. Van Duzer, Asst. Maint. Engr., State Highway Department, Harrisburg, Pa.

Directors for Two Years

C. M. Babcock, Commissioner of Highways, St. Paul, Minn.; H. K. Bishop, Chief, Div. of Const., Bureau of Public Roads, Washington, D. C.; H. S. Carpenter, Deputy Minister of Highways, Regina, Sask., Canada; J. H. Cranford, Pres., Cranford Paving Co., Washington, D. C.; E. J. Mehren, Editor "Engineering News-Record," New York City; I. W. Patterson, Chief Engr., State Bd. of Public Roads, Providence, R. I.; Wm. R. Smith, Pres., Lane Construction Corp., Meriden, Conn.

Directors for Three Years

Will P. Blair, Vice-Pres., National Paving Brick Mfrs. Assn., Cleveland, O.; R. Keith Compton, Chmn., Paving Commission, Baltimore, Md.; S. T. Henry, Vice-Pres., Allied Machinery Co. of America, New York City; Fred A. Reimer, Engr., The Asphalt Assn., Newark, N. J.; H. G. Shirley, Chmn., State Highway Commission, Richmond, Va.; Frank Terrace, Pres., Washington State Good Roads Assn., Orillia, Wash.; Chas. M. Upham, State Highway Engineer, Raleigh, N. C.

Following the close of the annual meeting, the new Board of Directors met, elected Ethel A. Birchland, secretary pro tem, and an executive committee, consisting of Thomas J. Wasser, S. T. Henry and William R. Smith, with the president and the treasurer as members ex-officio. The board also took under advisement arrangements for the next convention and National Good Roads Show. Chicago was selected as the place of meeting and January 13 to 19, 1924 as the dates. The previous board had referred to the new administration a proposal made by the Highway Industries Exhibitors Association to the effect that the Exhibitors Association conduct the next show, but in the name of the American Road Builders' Association, and turn over to the latter out of the profits a sum, to be agreed upon, to cover the expenses of running that organization. This proposal was amplified and explained by S. F. Beatty, president of the Highway Industries Exhibitors Association and a vice-president, also, of the American Road Builders' Association. A thorough discussion of the proposal followed, terminating in the adoption, unanimously, of a motion to the effect that the American Road Builders' Association should conduct the 1924 National Good Roads Show, but in so doing should seek the cooperation of the Highway Industries Exhibitors Association. Authority for making detailed arrangements with the Exhibitors Association rests in the hands of the executive committee of the American Road Builders' Association.

The sessions were concluded with a get-together dinner, at which the chief address, on results of the Connecticut traffic survey, was made by Thomas H. MacDonald, Chief of the Bureau of Public Roads.

California Now Leads in Asphalt Roads

A statement compiled from the public records of the five Pacific coast states—California, Oregon, Washing-

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ton, Nevada and Arizona—shows that California laid more than twice as much pavement during 1922 as all four of the other states combined. Contracts were awarded for a total of 161,754,852 square feet—100,192,174 square feet of which was within the State of California.

The asphaltic types of pavement were well in the lead, representing 66.7 per cent of the total for the five states. Seventy-eight per cent of California's new pavements were of the asphalt types. This is by far the biggest year on record in that territory for pavements using asphalt in their construction.

Asphaltic concrete pavements have been laid on the Pacific coast since 1894, and the steady increase in their construction each year over the previous year is due to the unparalleled record for durability and low maintenance demonstrated by this type. One notable feature in reviewing the last year's record is that the cities and counties which have laid asphaltic concrete in the past and which have had an opportunity closely to observe its durability, are specifying asphaltic concrete for new pavements. This seems to indicate that the tremendous increase during 1922 has not been due to a temporary rush to a new and experimental type, but rather to records demonstrated by a tried and proven pavement.

The gains in asphaltic concrete surfacing on various types of bases and in asphalt and oil macadam pavements are even greater than those shown in asphaltic concrete. The total area of pavements laid in 1922, in which asphalt was used in the construction amounts to 107,773,079 square feet. If stretched out in a sixteen foot highway this would extend for 1290 miles.

California now has 44,775 miles of improved roads, according to a census compiled by the United States Bureau of Public Roads. Of this mileage a total of 1,789 miles are now of the bituminous types — sheet asphalt, bituminous macadam and asphaltic concrete. There are 1,355 miles of surface treated macadam, 30,499 miles of graded and drained roads, 240 miles of sand clay, 7,087 of gravel, chert and shale and 533 miles of water bound macadam. The total road mileage for the state is now 75,889 miles compared to 61,039 miles in 1914.

Springfield, Mass., Streets Withstand Severe Tests

The highways of Springfield, Mass., all things considered, sustained less damage from the ravages of winter than had been feared by the department of streets and engineering. According to a careful appraisal by Deputy Supt. Arthur Woodward, the amount of the damage to that city's pavements will not exceed $12,000.

Not that the pavements of Springfield escaped practically unscathed. On the contrary, Mr. Woodward said that it had been a hard winter on all classes of pavements except those of the sheet asphalt type. The asphalt pavements weathered the winter well.

The sheet asphalt pavements, of which 10 miles or more have been laid in Springfield during the past nine years, came through the winter almost wholly unscathed, showing little, if any, signs of wear.

The superiority of sheet asphalt pavement having been proved for this reason the Springfield department of streets and engineering intends to build more of this type in the future. This year it is the intention to build at least four miles of asphalt road.

Georgia Spends Over $4,000,000 on Roads During 1922

The State of Georgia spent $4,980,837.41 in road construction and maintenance during 1922 according to the report of chairman John N. Holder, of the state highways board, just made public. Of this amount, $4,480,939.50, or 89.98 per cent, was spent on actual construction and maintenance and only $271,532.99, or 5.45 per cent, for administration expenses. The report shows that $3,106,342.74 was received from the Federal Government and counties, $1,762,339.94 from the state treasurer, $2,354.73 from the interest on state funds, and $109,800 from the 1921 refund.

"The statement has been made," says the report, "that $675,000 has been spent by the state highway department for equipment during the current year. The records, on the other hand, as verified by the accountants appointed by the governor to go over the department's record, show that only $200,084.45 has been so expended. All of the equipment purchased was absolutely necessary in carrying on the work of the department. When the government donated its war equipment to the various states for road work, it was with the stipulation that this equipment be properly cared for and maintained. At our shops in East Point, therefore, there are a great number of trucks, tractors and cars that are undergoing repairs. The government has given the department some very valuable machinery for this work, and the least that the state can do is to carry it on.

"Again, the department has been forced, for lack of space, to rent quarters outside of the State Capital—another unavoidable expense. We hope, however, within the next thirty days, to move our offices to East Point, where the repair shops of the department are located, thus eliminating another item of expense.

"The Elbert quarry, owned and operated by the department, is now a going concern, and will pay for the money spent on its equipment many times over in years to come. The output of this quarry has been sold for years in advance. We believe that the system which we have evolved will be entirely satisfactory," says the report, in conclusion, "and that the expense of carrying on the work has been reduced to a minimum."

Calcutta, India, Builds American Type of Streets

That cities in India are adopting American types of street pavements is indicated in word received from that country. Asphaltic concrete pavements, now in such wide use on the Pacific coast with pronounced success and low cost for maintenance, are an American development, having been originated in this country and having been brought to a high state of perfection by American highway engineers. India has a very enervating climate and asphaltic concrete, according to James R. Coats, city engineer of Calcutta, is proving as successful there as in the United States. "Here in Calcutta," writes Mr. Coats, "we have laid 1,300,000 square yards of asphaltic concrete per annum during each of the last five or six years."

The biggest street improvement program in the history of Los Angeles, Calif., will be inaugurated this year according to Major L. A. Griffin, city engineer. Four hundred separate projects to cost $4,000,000 and embracing grading, asphalt paving, oiling, sidewalks, gutters and curbs are planned.

A. A. A. Holds Twenty-First Annual Meeting

Henry C. Wallace, Secretary of Agriculture, Principal Speaker

Henry C. Wallace, Secretary of Agriculture, was principal speaker at the twenty-first annual meeting of the American Automobile Association, held at the Biltmore Hotel, New York City, Tuesday, May 22. George C. Diehl, of Buffalo, retiring president of the A. A. A. presided. About 150 delegates, representing the principal automobile clubs in the United States, were present.

Thomas P. Henry, of Detroit, was elected president for the ensuing year; G. Roy Hill, of Minneapolis, Secretary; William C. Kirby, of Chicago, Treasurer. Vice-presidents were elected as follows: Charles A. Frazer, of Massachusetts; P. J. Walker, California; Frank S. Gold, Minnesota; Frank O. Miller, Florida; C. H. Verschoyle, Texas; Daniel R. Reese, Pennsylvania; Dr. L. S. Colter, Ohio.

The Association accepted into membership twelve automobile clubs, bringing the total membership to more than 300,000.

Through the adoption of resolutions, the A. A. A. went on record as favoring the removal of highway departments and officials from politics; favoring the government's taking over the obligation of both building and maintaining highways across unappropriated lands and Federal Reserves, instead of leaving this to be done by the State in which they are located, and again pledged itself to continue its efforts for the national system of adequate highways.

Secretary Wallace departed from his set speech to compliment the association on its work for Federal Aid to roads, and declared that the A. A. A. had no small part in making Federal Aid possible. He told of the disbursement of the funds and how they are handled, and also went into detail regarding the work of the Agricultural Department scientists for good roads, especially with reference to testing materials, solving drainage and other problems and fitting special materials to different soils. He told of the group of men, about 3,500, connected with his department, the largest single group of scientists in the world.

Dr. James W. Inches, former Police Commissioner of Detroit said that the most important problem confronting the police of every city is that of handling traffic. "We have been regulating the motorist for the past ten years," he said, "and it is time that we start to really regulate the pedestrian, as an unbelievably large percentage of accidents to pedestrians which result in injury or death, are due to the carelessness of the pedestrians.

Legislative problems menacing the motorist are facing automobile clubs in every state in the Union, Robert P. Hooper, of Philadelphia, a past president of the Association declared. Pennsylvania has even gone so far as to attempt to take the money collected from motorists for the payment of a deficit in general funds, instead of using it for road maintenance, he said. He called attention to the comparatively small number of organized motorists and declared that under the circumstances, the work done by the organization has been remarkable.

A. M. Loomis, Secretary of the National Grange, warned against the new socialist element that is creeping into the government, said that even the farmer, trained to think for himself and opposing socialistic ideas, is beginning to listen to this class of politician, whose chief stock in trade is the promise of lowered taxes. "Never before has there been such a revolt against taxation as there is today and the politicians are taking advantage of this state of unrest," he said. Mr. Loomis declared that many farmers are paying more in taxes on their farms than the farms would bring at a fair rental value.

Colonel Sidney D. Waldon, of Detroit and C. C. Cottrell of San Francisco, discussed the gasoline tax situation. Dr. H. M. Rowe, of Baltimore, declared that the minimum of accidents will never be reached until both pedestrians and motorists are equally regulated. Daniel Reese, of Scranton, Pa., told of club work.

The delegates were guests of the A. A. A. at a luncheon at the Biltmore at noon.

First 1923 Highway Project Completed Thrugh Jarr Canon

The first contract to be completed under the 1923 budget of the Colorado state highways department was that calling for the widening of the Jarr Canon road, one of the most heavy stretches of highway in the vicinity of Denver.

Contractor Richard McQueary finished the job early in April. He started on the work shortly after the budget had been completed last December and kept working throughout the winter months.

He is now engaged under the direct supervision of the highway department in grading, draining and surfacing the state highway from the Denver city limits south to Fort Logan, which is a continuation of Sheridan boulevard.

Large Sum Available for Road on "Roof of Garden of the World"

Tourists the world over will be enabled to travel the largest flat top mountain on the globe on as fine a mountain highway as ever was made from dirt, when the $75,000 now virtually assured for the circle trip of 130 miles over Grand Mesa. "Roof Garden of the World," has been expended by the forest service. Nearly 500 lakes, 200 of which are large, inviting spruce surrounded waters with thousands of trout beckoning fishermen and campers, are opened up to motorists by this route, none of them more than three or four miles from the main highway, and fully 50 of them lying just below the roadbed.

The appropriation of $30,000 for a good road between Mesa lakes and Alexander lakes, two groups comprising dozens of magnificent natural lakes, has been followed by word that $45,000 will in all probability be secured to meet this road with a similar six per cent grade reaching the Alexander group from Delta, on the other side of the mesa. This will make the entire length of the road, excepting five miles on the Mesa side, either forest highway or along the transcontinental routes; the five miles lying out of these classes is to be repaired to conform with forest specifications within the next few weeks.

Grand Mesa is a connecting link in the large V formed by the meeting of the Rainbow route and the Pike's Peak Ocean to Ocean highway in Grand Junction. The lakes region, with hotels, camp grounds, store facilities, etc., may be reached within 15 miles of the Pike's Peak road in Pleateau Canon or within 20 miles of the Rainbow route at Delta. There is at this time a reasonably good dirt road over this route, but with the additional expenditure of $75,000 it will rival any Rocky mountain highway ever built.

Colorado To Spend $7,767,596 for Road Construction During 1923

Unless unforeseen conditions develop, such as unfavorable weather conditions, lack of laborers or inability to obtain necessary materials, more roads will be constructed in Colorado in 1923 than during any year since the State, through the Highway Department, undertook to develop and construct a system of highways, says "Colorado Highway."

The Highway Department's budget for 1923 sets aside $7,767,596 for construction, and it will be the Department's aim to make every effort to "clean up" the budget.

Last year, shown by the records to have been the busiest in the Department's history, witnessed the improvement of approximately 1,160 miles of State Highways at an expenditure of $6,735,882.75. These figures, by comparison, will give an idea of the activities planned by the Department for the construction season just now getting under way.

When the Department was reorganized in May, 1921, those placed in charge of the Department's affairs mapped out a system of inter-state highways and connecting inter-county roads with a view of concentrating the state's efforts on the improvement of the roads embraced in this system. The system, embracing, roughly speaking, 3300 miles, was designed to serve the greatest number of people. It was submitted to the United States Bureau of Public Roads as the Federal Highway System in Colorado, and upon it is being expended the so-called Federal Aid money made available for Colorado by acts of Congress.

These interstate highways crossing the state east and west from the Kansas to the Utah line, and north and south from the Wyoming border to New Mexico, may be likened to the main lines of a giant railroad system, but as a railroad is dependent for its business upon what is known as "feeder" roads, so the Highway Department's plans provide for "feeders" to the main arteries of travel.

The entire system is so designed that every county seat and every principal city or town in the state is located on either a main interstate highway or a road connecting with a main interstate highway.

No matter where he lives, a resident of Colorado will be able, when the entire system is completed, to travel on an improved road to any part of the state.

The construction of these "feeder" roads, which in some instances are as important as the interstate highways, is being carried on with state money alone. No Federal Aid money is available for them under the rules laid down by the government.

For 1923 the budget sets aside $2,494,896 for the improvement of the "feeders," while of the money received from sale of bonds, the sum of $2,336,350 has been set aside for interstate or Federal system highways. For the latter the United States Government furnishes an additional $2,936,350.

In mapping out the entire system and making appropriations for the various roads the thought uppermost in the minds of the members of the highway advisory board and the state highway engineer was to build roads which would last; roads which would enable the farmers to get their products to market; and roads which would make it possible for the city merchant to get into easy touch with the man in the country. In other words, commercial roads above everything else has been the watchword of the department heads.

No one realizes the value of the state's scenic attractions more than the officials of the Highway Department. They are fully aware of the fact that tourists visiting the "Nation's Playground," as Colorado is aptly called, spend many millions of dollars in the state annually, but at the same time they full well realize that the needs of the people of the state must be the first consideration.

A careful study of the road system as laid out by the department and of the appropriations made will reveal that, with perhaps a single exception, not one of the many roads provided for can be classed as a purely "scenic" road. This lone exception is the highway now being constructed from Echo Lake to the summit of Mount Evans, for which in the 1923 budget, the sum of $50,000 has been set aside.

It might be mentioned that this road is being built to complete a circle trip through one of the most attractive regions from a scenic standpoint, in the State, which heretofore has been practically inaccessible. It is being built at the urgent request of the people of Denver.

The City and County of Denver contributes, roughly speaking, one-fourth of the money at the disposal of the Highway Department. Inasmuch as there is not one foot of state highways in Denver County, every dollar of Denver money is expended in some other county. For this reason the highway engineer and the members of the highway advisory board granted the request of the people of Denver for the construction of the Mt. Evans road.

This road will open up a veritable wonderland and will add materially to Colorado's reputation as a state of unparalleled scenery.

Many roads now under construction and about to be constructed are unequaled from a scenic point of view. This is practically true of every road which traverses the mountains. But in this respect the State is very fortunate that such is the case, for it makes possible to build roads, which while primarily commercial roads, are also attractive to the tourists. It might be said without fear of contradiction that every road west of the eastern foothills of the Rockies is a scenic road and a commercial road as well.

There are a number of scenic roads being constructed in the State and whose construction will continue in the future, but which are not being built by the State. They are being constructed as development roads by the United States Forestry Service. The latter is building them to open up the great Forest Reserves in the mountains and make them accessible to the people. These activities are being carried on independently of the State Highway Department, though the heads of the Forestry Service are cooperating with the State, and before a forest development project is placed upon the program, the forestry officials generally consult with the State Highway Department, in order that a maximum amount of good may be obtained from the forest roads and that the latter, as far as possible, fit in with the State's system of highways.

Types of roads to be constructed during the year comprise hard surface, gravel, dirt, etc. In selecting the type of road to be built, the Department is governed by local soil and traffic conditions.

It would be considered foolish to build concrete roads in the mountains, where the travel is light and where there is a good rock foundation for roads. On the other hand concrete roads are specified near the large centers of population, where the traffic is of such proportion that gravel or dirt roads do not stand up under the traffic.

In selecting roads for improvement and in selecting surfacing material, the watchword of the Highway Department, say officials, will be during 1923 what it has been the past two years:

"The greatest good for the greatest number."

Indian Roads in Good Condition

Three thousand miles of gravel and stone roads in the Indiana state highway system are in the best condition since the commission was organized in 1919, John D. Williams, department director, said today.

Recent rains laid the dust and in many localities this type roads are like velvet, surpassing for pleasure and comfort, travel over hard surface highways. Most of this mileage came through the winter in excellent shape due to constant maintenance and a system of road drainage installed in 1921.

"Our greatest problem at this time in state road work is maintaining adequate detours necessary where state roads are under construction," Mr. Williams said.

There are approximately 20 detours at this time on State Roads Nos. 1, 2, 3, 4 and 6. Detours on No. 1 (Range Line Road) exist in Marion, Hamilton, Tipton, Marshall and St. Joseph counties, all north of Indianapolis; on Road No. 2 (Lincoln Highway) just east and west of Ft. Wayne; on Road No. 3 (National Road) at Stilesville and near Reelesville; on Road No. 4 in Orange, Dubois and Spencer counties, and on Road No. 6 just west of Indianapolis at Flackville. The National road detour near Stilesville will be removed in about two months as the road will be completed at that section, highway officials state.

Hundreds of men with motor equipment have been working on all weak spots in the non-rigid type roads for the past few weeks getting them in nearly perfect condition for the motor traffic that will come to Indianapolis for the annual Memorial Day automobile derby.

In order that the thousands of persons who will drive to Indianapolis from all parts of Indiana and from the principal cities of many other states have proper information on detours, favored routes from various points, condition of state roads et cetera, the highway department will issue a traffic bulletin to help motorists in their overland journey to the Hoosier capital.

Plan Improvement of Indianapolis Boulevard

Indianapolis Boulevard, declared to be the heaviest motor traffic thoroughfare in the world, and the only motor artery between Lake county and Chicago, is to be widened, improved and beautified, if present plans under consideration by the Gary Commercial Club directors are acted upon by local state and federal highway authorities.

The proposed improvement includes the purchase of additional land for roadway purposes along the north side of the boulevard, the improvement by cement paving of an extra wide highway and the marking of this entrance to Indiana and Illinois with a large decorative arch and pillars, which will be illuminated and bear the words "Gateway to Indiana" on one side and "Gateway to Illinois" on the other.

Good Road Soon Repays Its Cost, Survey Shows

A good road is such a paying investment that it is the poorest kind of business judgment to do without it, according to the U. S. Bureau of Public Roads. The bureau produces figures based upon a survey of traffic in Connecticut to prove its contention. An actual count of the traffic on the Boston Post Road showed that the average weight of vehicles and commodities passing over the road in nine hours each day was 1,140 tons. Adding one-third as a conservative estimate for the full day increases the weight to 1,520 gross tons daily.

Experiments made at the Iowa Experiment Station show that with gasoline at 24 cents a gallon the cost of moving this tonnage over a dirt road would have been $26.44 a mile, assuming the impossible, that such traffic could be carried over a dirt road. The cost of fuel for moving the same tonnage over a paved road would be $11.70, a difference of $14.74 a day. On the basis of 300 days a year the actual saving in fuel alone for moving this tonnage would be $4,422. If the paved highway costs $40,000 a mile, the average interest at 5 per cent would be $1,000 a year, which, deducted from the saving on fuel, would leave a balance which would retire the cost of the road in less than 12 years.

This calculation does not take into account other savings in the cost of operating commercial vehicles or value of the heavy movement of passenger vehicles.

In less developed rural sections the value of the gasoline saved is reduced in proportion to the lighter travel, but the cost of the roads is correspondingly reduced, and there is no doubt that an analysis and comparison of the highway costs and the vehicle operating cost in any particular case will demonstrate the economy of improvement wherever the traffic is sufficient to call for any improvement at all.

Denver Maintains 989 Miles of Streets with Full Road Outfit

A total of 989 miles of streets are maintained by the highway department of the City of Denver. Besides the city has about 100 miles of roads in her mountain parks to maintain in condition, in addition to about 40 miles of roads through her city parks.

Equipment used on this work includes eight tractors, sixty-two trucks and twenty-two graders of varied sizes. The city also operates a large asphalt plant and sufficient equipment for the construction of new asphalt streets and the repairing of those already laid.

The early part of April the Denver asphalt forces started the annual spring repair work. At the same time constructors began work on extension of the paving on South Broadway to the city limits. This work will consist of laying two inches of asphalt on a slag base.

Asphalt Used to Repair Concrete Roads

Highway engineers in various parts of the country are finding it advisable in a greater degree to repair concrete roads with asphaltic materials. This is true particularly in Maryland, New York, California, New Jersey, Wisconsin, Illinois, Missouri, North Carolina, Oklahoma, Michigan, Ohio, Kansas, Iowa, Colorado, Texas and Canada.

Concrete roads are prone to develop longitudinal and transverse cracks. Everywhere these cracks are being filled with asphalt. Maryland has been resurfacing some of its concrete roads laid in 1913 and 1914 by means of asphalt. Among these is a two mile stretch of the Baltimore-Washington Boulevard near the Baltimore city limits that was built in 1913 of Portland cement concrete and resurfaced with asphalt in 1919. The road from Baltimore to Camp Meade, built in 1914 of compressed concrete, was resurfaced with asphalt also in 1919.

In Baltimore city it has been found necessary to give some concrete a flush coat of bituminous material covered with gravel.

In New York a number of concrete roads have been resurfaced with asphalt. All told, up to 1921, eighty miles of concrete roads laid in this state from 1912 to 1914 had been so resurfaced. Among these were the Cicero-Brewerton road in Onondaga county, four miles long, and the Moravin Lake Road in southern Cayuga county. Eight miles of concrete road in Suffolk county have been resurfaced with asphalt. Port Chester, N. Y., applies asphalt and grits to old concrete pavements. In Waverly, N. Y., it is the practice to cover concrete with bituminous macadam and gravel.

California has resurfaced a large mileage of its concrete roads with asphalt. From the beginning it has been the plan of the State Highway Commission ultimately to cover all its concrete roads with bituminous materials. In New Jersey, at Camden, it is the practice of the engineers to lay a complete asphalt top with binder on concrete pavements. Roselle Park, N. J., repairs the cracks in concrete with bituminous materials covered with sand.

In Milwaukee county, Wisconsin, a section of the Kilbourn Road, running from the Milwaukee city limits to the Loomis Road, built of Portland cement concrete in 1913, was resurfaced with two inches of asphalt in 1919 It is the practice in Chicago, Ill., to resurface concrete with one and one-half inches of asphalt binder and one and one-half inches of asphalt top, or two inches of asphaltic concrete. Chicago Heights and Freeport, Ill., resurface concrete with sheet asphalt under standard specifications. In Webster Grove, Mo., it is the practice to cover old concrete with bituminous materials and gravel. In Kansas City the engineers first repair the pavement so as to bring it uniformly about two inches below the finished surface. Then they thoroughly clean it and cover it with a light application of asphalt. A two inch thickness of asphaltic concrete is then laid on top of this and thoroughly rolled.

In Greensboro, N. C., City Manager P. C. Painter has found "that in laying concrete pavements, due to their short life, it is advisable to lay them with a little greater gutter surface than would normally be the case, so they can be resurfaced later with either bituminous concrete, sheet asphalt, brick or any other type of material which traffic conditions at the time of resurfacing would seem to justify." In Ada, Okla., concrete pavements are resurfaced with asphalt. In Hugo, Okla., 5,000 square yards of concrete pavement have been treated in this manner. Similar practice has been found necessary at Washington, D. C., Richmond, Calif., Owosso, Mich., Perrysburg, O., Ottawa, Kans., Des Moines, Ia., Boulder, Colo. and Denton, Tex.

An eight mile stretch of the St. Lawrence Boulevard, Province of Quebec, Can., built originally of Portland cement concrete, has been resurfaced with asphaltic concrete. Concrete pavements at Mimico and Windsor, Ont., have likewise been resurfaced with asphalt.

What Penn. Uses in Repairing its Roads

The materials to be used during the 1923 season in the repair work undertaken by the State Highway Department of Pennsylvania will load 113 solid freight trains of 70 to 104 cars each. The stone the department will use would build a rock-fence three and a half feet high and 370 miles in length—a wall extending from Philadelphia over the Lincoln Highway to Pittsburgh and thence to a point near Greenville, Mercer County. The oils, tars and asphalts to be used by the department would give two coats of paint to a roof large enough to cover the cities of Pittsburgh and Altoona. The State Highway Department recently opened bids for stone and bituminous materials. Bids are asked on 405,328 tons of stone and 6,274,164 gallons of materials for road treatment. The stone will be used in resurfacing and in repairs to macadam highways. Of the bituminous materials, 1,669,112 gallons are for the use in the building of penetration macadam thoroughfares by the department's maintenance forces, and 4,578,052 gallons are for surface treatment.

The huge gallonage of bituminous material will fill 785 tank cars, or 12 trains of 70 cars each. The stone to be bought will make up into 113 trains of 100 cars each. These trains standing together would extend from Harrisburg to within a few miles of Williamsport—87 miles in all. The past winter has been particularly damaging to macadam roads in Pennsylvania according to officials.

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Minnesota to Spend $26,000,000 on Counties, Townships, and Cities' Roads This Year

Motor Vehicle Revenue of $6,500,000 Is Only Direct Levy for State Highways

Four out of every five vehicles using Minnesota roads are found on the state trunk highways, but the use of road money is almost exactly reversed, four out of five dollars going on the local roads—other than trunk highways. The showing is made on official figures in a new state highway bulletin. Trunk highway funds to be expended in the various counties during 1923 cannot be estimated at this time, but on the basis of the amount available for the big 7000-mile heavy traffic system will not average to exceed 25 per cent. of the total going on local roads.

The bulletin makes plain that the closer control the people have over road taxes, the larger are the funds voted for road improvements and maintenance. Local road funds of $25,899,000 are available for use this year, official figures show. The big part is made up of tax levies of $8,332,682 by counties, $6,445,121 by townships and $1,104,318 by cities and villages. State aid adds more than $2,000,000 and the balance is proceeds from county bonds.

For trunk highways $5,850,000 of current revenues will be available, the bulletin states. Motor vehicle tax collections are estimated at $6,500,000 and the Federal aid is placed at $1,850,000. But a deduction of $2,500,000 must be made for county reimbursement bonds and interest. Any other funds for use on the trunk routes this year must come from new issues of county reimbursement bonds as authorized by the last legislature. Highway officials predict that such issues by counties will approximate $4,000,000 for the next 2-year period.

Local Levies Lower

Minnesota counties, townships and cities and villages reduced road and bridge levies $2,288,000 the first year after the main highways were taken over by the state. This year the county and city-village funds are cut $2,200,000 more, but townships voted on increase of $445,000. The net reduction is about $1,760,000. Nevertheless, under the new plan, more rapid progress is being made in local road improvements at the same time road tax levies as a whole are being reduced.

The increase voted in township road funds is pointed to as controverting reports that Minnesota farmers favor the slowing up of the good roads work. Farmers of the state have a more direct voice in raising these than any other road funds, and the increase is regarded as evidence that they realized that good roads taxes are cheaper than "bad roads taxes."

Counties benefit most under Minnesota's new plan of highway development, the bulletin states, because they are relieved of responsibility for the improvement and maintenance of the main heavy-traveled highways. This change was the same as giving the counties five times as much road and bridge money, the main roads always having taken about 80 per cent. of the total funds. Also, farms on the trunk highways pay relatively the same county and township road taxes as other farms, but the money all goes back on the county and township roads, none being used on the trunks.

Another gain for rural roads is the fact that although about a third of the automobile taxes are paid by owners in Minneapolis, St. Paul and Duluth, not a dollar is used within those cities. This was mentioned by farmer members in the legislature recently when the new law was passed reducing the average auto tax for 1924 below the $18 figure agreed to under Good Roads Amendment No. 1.

Trunks Pay Own Way

Friends of the good roads program insist that the trunk highway system is paying its own way under the provision that the motor vehicle funds are the only tax revenues that can be used on them. Tests and figures show that the tax paid on the average automobile or truck is more than returned to the owner in savings on repairs, gasoline and tires resulting from operation on improved roads. The auto tax, incidentally, is less than that under the old personal property and state license laws.

Better trunk highways are credited with being an important factor in attracting to Minnesota thousands of tourists who spend upwards of $30,000,000 a season. This item of new money is held almost enough to reimburse Minnesota for trunk highway expenditures, regardless of the greater benefits to residents of the state.

The state good roads plan may be

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improved, it is said, by passage in 1924 of the constitutional amendment to authorize a "gasoline tax." Such a tax at 2 cents a gallon would yield $3,000,000 or more annually of extra road funds and cost the average automobile owner about $8. It would allow visiting tourists to contribute toward the cost of the roads they use while in Minnesota.

Funds Allotted for Roads in Utah National Forests

Expendituses totaling $106,700 of national forest highway funds have been approved by Secretary of Agriculture Wallace to apply on 3 road-building projects in Utah. This money was made available for roads within or adjacent to the national forests which are of primary importance to states, counties and communities.

A total of $80,000 was allotted for the road between Panguitch and Tropic, a distance of over 7 miles in the Sevier National Forest. Funds totaling $43,000 have heretofore been allotted for the construction of this road, making a total of $123,000 thus authorized for expenditure.

For the section of the Cedar Long Valley road running between Duck Lake and the North and South Highway in the Sevier National Forest, an additional $18,700 has been allotted, making a total of $87,700 from the national forest highway funds authorized for expenditure on this project. In addition, $26,700 of other Federal road funds has been allotted to this project, and $2,600 is expected to be furnished by local authorities, thus bringing the total for this project up to $117,000. The length of the project is 17 miles.

In the Powell National Forest a road project 2 miles in length, forming a part of the Escalante-Widtsoe highway, has been authorized and the expenditures of $8,000 approved. This project will run from the ranger station to the foot of the mountains and will be of great value to the town of Escalante, as well as of value in the administration and protection of the Powell Forest. The construction work will be handled by the forest supervisor.

Contract for Final Paving on Lincoln Highway in Illinois Let

The contract for paving the last unpaved section of the Lincoln Highway in Illinois was recently let and the work has already started. The contract involves about 13 miles between Plainfield and Aurora and will be completed this fall. Some elaborate plans are being made for a celebration upon the completion of this paving to mark the completion of a concrete road entirely across the state on the Lincoln Highway.

Remarkable progress has been made in finishing the Lincoln Highway in Illinois when it is considered that in 1914 there was not a foot of pavement outside municipal limits entirely across the state. Some $5,000,000 has been invested by the state in the 172 miles of Lincoln Highway between the Indiana line and the Mississippi River. This fall Illinois will enter the ranks of those states which have fianlly completed improvement of the Lincoln Highway, started upon in 1913. Only one other state has completed the pavement of the route, it being New Jersey.

Pennsylvania completed 7.24 miles of new concrete construction on the Lincoln Highway last year at a cost of $439,033, or an average cost per mile of $60,723.75. Consistent progress is made by the state each year on its program of reconstructing the Lincoln Highway between Philadelphia and Pittsburgh with concrete. The maintenance on the old macadam while perfect is very expensive, averaging during 1922 on 320 miles of the route $1,744.86 per mile, an average materially below that of 1921.

Kentucky to Build New Road from Louisville to Tennessee Line

At the last meeting of the Kentucky State Highway Commission, the decision was reached to accept $50,000 as a donation from the Hardin County Fiscal Court to be used on resurfacing the Western Dixie Highway from Elizabethtown to the Hart County line. This means that a combination between the northern end of the Western Dixie and the southern end of the Jackson Highway can be made with the result that a good surfaced road will be had from Louisville to the Tennessee line.

Already Hart County has undertaken the repair and reconstruction of the Western Dixie from Hardin County line to Bonnieville. From Bonnieville to Munfordsville is now under State maintenance, while from Munfordsville to Horse Cave the road is being reconstructed by Hart County with the idea of having it accepted for State maintenance. From Horse Cave to Bear Wallow is already under State maintenance and from Bear Wallow to Glasgow and seven miles beyond is under construction. From this point to the Allen County line, there is about seven miles of road to be reconstructed, while beginning with the Allen County line, the road is in reasonably good condition to Adolphus. From here to the Tennessee State line, a distance of less than two miles, considerable work will be necessary to make traveling comfortable.

This plan will result in a good road than can be traveled the year round all the way from Louisville to Tennessee. If either the Western Dixie or the Jackson Highway were to be constructed throughout, several years would be required, before a continuously good road would be had from Louisville to the Tennessee line.

The remaining link of the Jackson Highway in Jefferson, Bullitt, Spencer and Nelson counties has been let for construction. This when completed will result in a high-type surface all the way from Louisville to Bardstown. While from Bardstown to Buffalo and twenty miles or more in Hart County will remain to be constructed before the work now under way at Bear Wallow will be reached. Certainly several years must be required to finish all of this, while with the combination between the Western Dixie and Jackson highways, it will be posible to have a year-round road crossing the State by the beginning of 1924, with exception of seven miles in the southern part of Barren County.

There will be very little delay to the completion of the Jackson Highway by reason of the work done on the Western Dixie between Tip Top and Bear Wallow. Furthermore, it is almost necessary to put the Western Dixie in condition for use as a detour during the construction of the Jackson Highway south of Bardstown.

The amount of work necessary in making the Western Dixie an all-year road is comparatively little to what must be done on the Jackson Highway, for the Western Dixie has been very well located so that hardly any changes need to be made in the alignment. The foundation of much of it is sufficient to support a macadam top for a number of years.

A north and south road crossing Kentucky near its middle will bring a large number of tourists into and through the State. It is particularly fortunate that this highway passes very close to one of the seven wonders of the world—the Mammoth Cave—for the probability is that more of our visitors are interested in seeing the cave than any other point in the State, so this road will be an especial boon to the greatest number from outside the State.

Oregon Has Unique Feature of Road Construction

Clackamas County, Oregon, has entered upon the construction of a paved market road system which will eventually comprise 145 miles of highway and make the county a leader in Oregon road building. The unique feature of this plan is that most of the mileage will be of single track construction. It is argued that a nine-foot paved strip with a gravel road along the side, will prove sufficient for present needs.

Nine miles of the project have already been completed.

Work Resumed On 89 Road Projects in Many Forests

With the opening of the forest road construction season now at hand, the U. S. Bureau of Public Roads reports that there are 89 projects involving 717 miles of road upon which work is being resumed and a number of new projects for which contracts have been recently let.

The projects upon which work is being resumed are distributed as follows:

State	Proj'ts.	Mil'ge
Alaska	8	24.00
Idaho	17	110.00
Montana	8	70.00
Washington	8	54.00
Oregon	22	148.00
California	4	40.00
Colorado	7	103.00
South Dakota	2	13.00
Wyoming	3	56.00
Arkansas	1	10.00
New Hampshire	1	0.02
Virginia	1	7.00
Utah	5	30.00
Arizona	1	44.00
New Mexico	1	8.00
Total	89	717.02

One hundred and seventy-five projects, involving 1487 miles of forest road, have already been completed.

New York State Not Receiving Real Competitive Bids Says Commission of Highways

Recent lettings for highway construction held by the Commissioner of Highways at Albany, clearly demonstrate that the State is now receiving no real competition from contractors, states Frederick S. Green, the Commissioner of Highways. In spite of the fact that the Department has materially increased its estimates for road building, contractors are reluctant to submit proposals.

After a conference with his nine Division Engineers, who reported conditions in all counties, Commissioner Frederick Stuart Greene has decided that, in the interest of the State, it is necessary to curtail further new construction until the vitally necessary reconstruction work has been provided for.

The State has now in force 217 highway contracts amounting to more than $28,500,000, on which less than $9,000,000 of work has been performed, leaving $19,500,000 of unfinished work. In addition to this large amount of uncompleted work, the Department will make every effort to award contracts amounting to $5,000,000 for the reconstruction of old roads which have gone to pieces. This proposed reconstruction work added to contracts now unfinished, will reach a total of $24,500,000, which is more road work than the Department has ever accomplished in any one year.

The conditions which have made necessary the curtailment of new construction are freight embargoes, scarcity of materials and shortage of labor.

The Commissioner realizes that a policy of continuing to raise prices, in an effort to encourage contractors to submit bids, would not only make it impossible for firms which now have work at lower figures to complete their contracts, but would rob the already undermanned farms of necessary labor. It has been determined, therefore, that except for a few important connecting links and some heavy grading contracts, which by the use of machinery will require but few men, there will be no more new construction attempted until the abnormal conditions in transportation, material and labor have returned to a level at which it is advantageous for the State to proceed with its highway program.

This postponement of new work means that $16,000,000 of contemplated highway construction is deferred.

Asphalt Association Engages Two New District Engineers

The Asphalt Association, J. E. Pennypacker, secretary, announces the creation of two new district offices for field work and the appointment of two field engineers to succeed James R. Valk, deceased, and John B. Hittell, resigned. A third district engineer will be appointed shortly.

The southeastern district of the association of which the late Mr. Valk was manager, has been undergoing reorganization, the headquarters having been moved from Atlanta, Ga., to Charlotte, N. C. Mr. Valk's successor is Lloyd D. Smoot of Washington, D. C., formerly general superintendent of the Atlantic Bitulithic Co. Mr. Smoot's career has included seven and one-half years of service as Director of Public Works at Jacksonville, Fla., as well as long practical experience in asphalt paving construction. During the World War he was a Captain of Engineers, U. S. A. H. P. Grier of Statesville, N. C., remains with the Charlotte office as engineer in charge of field work in North Carolina. Mr. Smoot will devote most of his time to other southeastern states.

As successor to John B. Hittell, who resigned recently as district manager in Chicago, to accept reappointment to his old position as chief street engineer, Chicago Board of Local Improvements, the association has appointed George W. Craig, for the past ten years city engineer of Calgary, Canada. From 1909 to 1913 Mr. Craig was chief engineer of the city of Omaha, Neb. From 1907 to 1909 he was engaged in engineering and contracting as a member of the Katz-Craig Contracting Co. Throughout his career he has been prominent in such organizations as the American Society for Municipal Improvements and the American Society for Standardizing Specifications. Mr. Craig was chairman of the original asphalt committee of the Association for Standardizing Paving Specifications and is, at present, a Councilor of the Engineering Institute of Canada. He is now in charge of the Asphalt Association's western office in Chicago.

Arrangements are being made by the Asphalt Association to open a new southwestern district office shortly in Kansas City, Mo., and announcement as to the engineer to be placed in charge of this district will be made shortly. With an office established in Kansas City, the Asphalt Association will have a total of five district branches, located at Kansas City, Mo.; Chicago, Ill.; Charlotte, N. C.; Albany, N. Y., and Newark, N. J. The main offices of the association are at 25 West 43d street, New York.

Kentucky to Make New Road Material Survey

The need of a comprehensive survey of road building materials found throughout Kentucky, has long been felt, but the funds for such an undertaking and the man suited to the work were neither available.

Very recently a co-operative arrangement has been made whereby the State Highway Department and the State Geological Department will undertake the financing and execution of a complete road-building materials investigation of the entire State. The investigation will be made and the report prepared by Dr. Richardson, of Syracuse University, Syracuse, N. Y., who will start the undertaking in June and complete the manuscript before the first of the following year. It is believed that Dr. Richardson is better equipped for making such a report than any other man available. He has spent two summers in Kentucky, the first on an investigation of glass sand and the second making a study of building stones. Dr. Charles H. Richardson has for a number of years been very closely associated with the building stone industry in the New England States. At Syracuse University he is professor of minerology. Twenty-eight years of experience in geology are accredited to him.

The scope of the report has not been exactly determined, but it is certain that the gravels of Western Kentucky, limestone of Central Kentucky and the sandstones of Eastern and Western Kentucky will all receive due attention. A tabulation of this kind will not only benefit the State Highway Commission, but will very materially asist the county officials in the choice of local materials to be used in construction of county roads.

If the work goes according to schedule, it is probable the report will be out in book form about the first of 1924.

France is Rebuilding Roads

The French Government has at last found itself in a position where it is possible to undertake the rebuilding of the national roads that were so terribly destroyed in the war, partly from the ruthless destruction of the enemy, and partly from the passage of heavy guns and ammunition wagons over them. The almost useless condition of some of the main roads has been a tremendous drawback to transportation, both for sightseers and merchandise, and the re-building has only been put off because of the lack of money to do it. However, it is satisfactory to find that a program has been laid out for the repair of some 7500 kilometres or about 4660 miles, and this is being divided between what may be called business roads, and those which are used by the tourists, as both are valuable.

The repairing of the roads, and of the ruined public buildings has already cost 48,637 million francs, and only 171 buildings out of the 6575 that were destroyed, have been repaired.

Paving Brick After 14 Years in the Street, Worth More Today Than When They Were Bought

Radiating from Jacksonville in various directions through Duval County, Florida, are four brick roads of various lengths which give conclusive evidence, says "Dependable Highways," of the superiority of brick among paving materials and the advantage gained by the public in surfacing highways with this material. The highways by name are the King's (Dixie) Highway, Lackawanna Road, Tallahassee Road and Pablo Beach Road.

These thoroughfares were paved with brick 13 and 14 years ago, according to a very simple design. The brick were laid directly on fine Florida sand—universal in this part of the country—with a curb at either side, much of it vitrified clay curbing. Originally no other material but fine sand was used as a joint filler.

During 13 or 14 years these pavements have borne an increasingly heavy traffic, both as regards volume and density, and yet today, with little or no attention paid to maintenance, these thoroughfares can be comfortably and safely traveled at speeds upward of 40 miles an hour.

Now, for the economic history. The original cost of construction on all of these roads was $1.48 or $1.49 per square yard laid, plus the additional amount of 18 cents per lineal foot for curb. No record is available as to maintenance cost, but officials agree that it has been negligible. Today the brick in these highways, many of them originally purchased as No. 2s and sold at No. 2 prices, are worth more in dollars per thousand than the day they were laid.

A section of the highway to Pablo Beach recently was taken up and relaid with asphalt filler at a cost of 73 cents per square yard, thereby providing an adequate highway for many years in the future. Surely few paving materials can present an equally attractive, economic record.

States Urged to Expedite Building of Main Roads

The principal highways of every state should be constructed as rapidly as the available supply of labor and materials permits. They should be constructed and maintained by the State Highway Departments and they should be paid for by the people of the states as a whole, according to Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads.

Mr. MacDonald says that actual road tests have shown that the annual saving in gasoline alone on the more important roads will, in some instances, more than pay the yearly cost of such roads, including a proper distribution of the first cost. The public pays for good roads whether it builds them or not. This fact alone, without regard to the increased need for highway transportation to supplement the railroads, the saving in wear and tear on vehicles, and the social, recreational, and educational advantages of good roads in rural sections, Mr. MacDonald says, should cause the states to proceed with their improvement of their main roads as fast as physical limitations permit.

The burden of building and maintaining the main state roads must be shouldered by the state, in Mr. MacDonald's opinion. It is not fair to expect a county to provide for the construction and upkeep of the main state roads within its borders when, as is generally the case, the traffic on such roads comes in greater part from outside of the county. The attempt to finance the improvement of such roads has been the means of bringing a good many counties to the point where they are not able to properly provide for the feeder roads, which should be their principal concern, because their credit is tied up in a relatively short mileage of high-priced road which should have been built with state funds.

Oregon Roads Receive Aid From Forest Highway Funds

Expenditures totaling $367,250 of national forest highway funds to apply on the construction of over 110 miles of highway in Oregon have just been approved by Secretary of Agriculture Wallace. This money was made available for roads serving national forests and for roads within or adjacent to forests which are of primary importance to states, counties and communities.

Among the projects for which these expenditures were authorized is one in Lincoln County running east from Waldport for nearly 16 miles. This highway is within the Siuslaw National Forest and forms a section of the Alsea River project extending from Waldport to Tidewater Bridge. Local authorities will appropriate $30,000 for this work to which the Forest Service will add $18,000.

An additional $37,500 has been authorized for the Eugene-Florence highway between Rainrock and Blackly in Lane County. With the funds furnished by the county this additional appropriation brings the total for this 24-mile stretch up to $375,000. The road is within the Siuslaw National Forest and is a part of the State Highway System, being one of the important east and west routes through the state.

The sum of $22,500 has been authorized by the Forest Service to apply on eight miles of road in Deschutes County running east from Belknap Springs. State authorities have appropriated a like sum for this project which lies within the Deschutes National Forest and forms a link in one of the state's main east and west highways.

For the stretch of road between Prospect and Crater Lake in Jackson County, a distance of 8½ miles, the sum of $67,500 has been set aside. This appropriation is additional to funds heretofore appropriated by Federal and local authorities for the construction of the 22 mile stretch between Trail and Prospect within the Crater National Forest.

A section of the Coast Highway extending nearly 5 miles from Neskowin to the Siletz River is also included within the projects, the sum of $108,500 having been set aside for this work with the state and county authorities appropriating an equal amount. The road lies within the Siuslaw National Forest.

About 10 miles of the Mount Hood Loop Highway is to be surfaced at an estimated cost of $75,000, half of which amount has been appropriated from the Federal forest highway funds and half from state funds. This road lies within the Oregon National Forest.

In Douglas County within the Siuslaw National Forest over 3 miles of highway is to be constructed between Mill Creek and Brandy Bar. This road is a section of the Scottsburg-Reedsport highway which forms an east and west connection between the Pacific and Roosevelt highways and is the natural outlet for the Coos Bay district into the Willamette Valley and Portland. The cost of the construction work is estimated at $110,000 of which half is from the Federal forest highway funds and half from county funds.

Lincoln Highway Association Extends More Aid To Nevada To Complete Great Road

Over $100,000 Given State to Aid Present Lincoln Way Improvement—All Poor Sections Now Under Contract

At the recent meeting of the Board of Directors of the Lincoln Highway Association a fourth improvement contract between the Association and the State of Nevada was ratified. Under the terms of this contract $7,500 additional, from the Willys-Overland trust fund, placed at the disposal of the Association by the Willys-Overland Company to aid improvement on the Lincoln Highway in the West, was made available to the state for urgently needed construction in Eureka County.

The amount contributed by the Associaton, as aid to the state, may seem small when the length of the improvement contemplated is considered, but the fact that Nevada receives about $8 from the Federal Government as aid in the highway construction for every dollar provided by the state, or, in this instance, by the Association, should not be overlooked. The cost of the 22 miles of improvement covered by the contract recently closed is estimated to be $277,260.00. The Association's aid made available close to $70,000. Work is already under way on this project, the fourth the Association has aided in Nevada.

In total the Association has provided Nevada with $107,500 which to date has aided the improvement of 95 miles of the trans-state road costing close to $900,000.

Negotiations are now under way between the Lincoln Highway Association and the Nevada Department of Highways for additional aid to the state for improvement required along Lake Tahoe. All sections of the Lincoln Highway in Nevada requiring prompt improvement for the through traffic are now under contract and all contracts will be completed before June 1st, 1924.

In connection with the aid the Association has extended to the state, the State Highway Commission has the following to say in its recently published report:

"The donation of this sum of money from an outside source for use in a county, such as Eureka, where local finances are necessarily limited, means a great deal and oftentimes enables the carrying out of construction work which might not otherwise have been possible. All of the various donations of this Association have been applied on projects in counties where similar financial conditions have existed and have allowed the state to go ahead with a large amount of construction work on sections of highway greatly in need of improvement which probably could not have been improved for some years to come, due to the attitude of local officials that funds should first be expended on the sections near the centers of population. It may be said, therefore, that these donations of the Lincoln Highway Association have meant a great deal to the state in the rapid improvement of trans-state highway, thus bringing into the state great additional numbers of cross-country tourists who might have otherwise taken some other road across the continent."

Motor cars seem the accepted and popular method of transportation and travel of the day. As automotive vehicles increase the demand becomes more and more insistent for adequate all-year highways.

In less than two years a great business—that of overland transportation and trucking—has sprung into existence. It is ever being augmented by pleasure travel and in recent months, by passenger carriers.

Where primary roads are hard surfaced, bus lines are operating and thousands of persons are patronizing this method of transportation.

Interest in the state highway system, especially as to road construction, maintenance and condition of highways is now more paramount than at any other season of the year because the state is engrossed in a road building program of considerable proportions and thousands and thousands of people are spending many hours each day in their motor cars.

Due to its geographical location Indiana is in the pathway of a great volume of transcontinental traffic. The National road is the highway through Central States from the Atlantic to the Pacific seaboard. Several primary roads serve the north and south traffic and today sees hundreds of resorters traveling to their northern homes after wintering in the southlands.

Governor McCray, members of the state highway commission and the director, recognize the importance of Indiana's good roads to the motoring public; also that if this state is to progress as it should industrially and agriculturally, money spent for trunk lines will yield vast returns in prosperity and contentment. To this end the state is committed to a construction and maintenance program in the next three years that will advance the interests of every Hoosier in manifold ways.

Big business interests recognize the dire importance of state highways and their close connection with the general public. A few days ago one of the big oil companies, the Standard of Indiana, Inc., perfected arrangements with John D. Williams, state highway director, that bulletins on state roads be sent to their three main branches, Indianapolis, Evansville and South Bend. "Daily we have thousands of calls for information on state roads for the public is using the state system almost exclusively when traveling to extent through the commonwealth," said a representative of this company. "We propose to take your weekly traffic bulletin and disseminate from the three main offices copies to each of our filling stations in the state, for it is a service that the public wishes and we desire to extend."

Expenditures totaling $28,576 of national forest highway funds and $71,424 from other Federal road funds for the construction of 19 miles of roads in North Carolina have just been approved by Secretary of Agriculture Wallace. The national forest highway fund was made available for roads serving the national forests and for roads within or adjacent to the forests which are of primary importance to States, counties and communities.

Yancey County, North Carolina, has offered $30,000 and McDowell County $105,000 for use in constructing the highway which is an important section of the Marion-Micaville road connecting the county seat towns of these two counties. The State of North Carolina has offered funds to complete the road building project, estimated to be around $216,843.

The road in question is entirely within the Pisgah National Forest and runs in a northwesterly direction from Garden City in McDowell County. It is planned to let bids and start construction this year.

At the recent session of the Washington State Legislature $10,314,245 was appropriated for a two-year program, which has been initiated this year. In addition, $300,000 was made immediately available for maintenance work, $1,670,000 for continuing work on the Pacific Highway, and $1,000,000 to match federal aid. The legislature also changed the title of the supervisor of highways to state highway engineer and transferred him from under the supervision of the department commission, which is composed of the governor, state treasurer and three appointed members.

Northampton County, Pa., Builds Connecting Roads of Concrete

Paved highway construction in Northampton County, Pa., according to a writer in a recent issue of "Concrete Highway," was begun in 1915, when the State Highway Department built a 3.35-mile stretch of concrete highway between Easton and Bethlehem. Since then both the State and the County have been adding to the mileage of all-weather roads. The $2,000,000 bond issue passed by the people of the County in the summer of 1922 insures an extension of the concrete highways which are serving the people so well.

Northampton County, with its great natural resources and its tremendous industrial activities, has benefited in full measure from the paved highways. The Easton-Bethlehem-Allentown Road, connecting the three great industrial centers in the Lehigh Valley, is the oldest of these concrete highways and shows the greatest development. Real estate values along the highway have increased $15 to $50 per front foot and attractive homes and new subdivisions have sprung up in many places.

The industrial development has been equally important. Many manufacturing concerns prefer locations where their products can be shipped either by rail or by truck and the territory adjoining the Easton-Allentown Road provided this desirable feature. As a result many new concerns have erected plants in Northampton County.

The history of development along the Easton-Allentown Road is repeating itself along some of the newer concrete highways. The Easton-Tatamy Road along Bushkill Creek, especially, has opened up desirable locations for manufacturing establishments. This road runs through an industrial section north of Easton and was built to furnish highway outlets for factories already in operaation as well as to provide a through north and south highway. Here also several new manufacturing enterprises have selected locations.

The service rendered by the Easton-Allentown Road won the confidence of the people of Northampton County and showed them what paved roads would do for a community. The next road constructed was the highway from Martin's Creek to Bangor in the northeastern section of the county. The County had agreed to provide 50 per cent of the cost of the improvement but was released when Federal Aid was secured for the project.

Then during the years from 1917 to 1920, there followed the construction of 24 miles of concrete road all of which were on the secondary or County highway system except 7 miles which were built jointly by the County and township. Funds for the construction of these roads were provided by general taxation from the County Treasury. During this time the State Highway Department had built an additional 17 miles of concrete highway on the Primary highway system. The entire cost of these roads on the primary system as well as the cost of engineering and supervision in building the county roads was borne by the State.

In the fall of 1920 a bond issue providing $1,000,000 for highway construction was authorized. It was not necessary to submit the issue to a vote of the people because the amount involved was less than two per cent of the assessed valuation of the County. These bonds provided funds for the construction of 25 miles of concrete highway.

But the people of Northampton County wanted more roads of the same type and to provide funds for this additional mileage a bond issue of $2,000,000 was voted by the people in the summer of 1922. Plans have already been made for the construction of 45 miles of highway which will close the gaps in the present paved road system and tap other sections of the county not yet served by improved highways.

The completion of these roads will provide Northampton County with a comprehensive highway system serving its varied industries. The slate and cement producing sections, the industrial sections and the farming sections will be linked with the cities and with the improved highways in neighboring counties. Northampton County's faith in concrete highways is the result of experience. For more than seven years the first concrete highway, built under the careful supervision of the State Highway department, has satisfactorily carried an ever increasing burden of traffic and has indicated the measure in which properly built concrete roads can serve a community. When the roads now projected are constructed Northampton County will have the finest and most complete system of concrete highways of any county in Pennsylvania.

The Pennsylvania State Highway Department so far in 1923 has broken all its records for oiling. During the week ending May 26 over 120 separate road sections will be given surface treatments.

Oil will be found on the Lincoln Highway, the William Penn Highway and almost every other main route in Pennsylvania. Only one side of the road is being oiled at a time.

During the last few days the detour in Monroe county, east of Stroudsburg, on Route No. 166, has been removed, as has the detour on Route No. 271, Erie county, near Waterford.

New detours will be found on Route No. 236, in Bucks county between Clarion and East Brady; south of Clarion; and in the vicinity of Beaver Falls.

HIGHWAY CONTRACT NEWS

CALIFORNIA

Bids will be received at the office of the California Highway Commission, 515 Forum Building, Sacramento, Cal., until June 4, 1923, for construction of portions of state highway, as follows: Los Angeles County, between Fish Canyon Road and Azusa, about 1 mile in length, to be paved with Portland cement concrete. State highway engineer's estimate —17,700 cu. yd. embankment without classification, 2,800 cu. yd. Class "A" Portland cement concrete (pavement), 5 cu. yd. Class "A" Portland cement concrete (culverts and monuments), 84 lin. ft. 18 in. reinforced concrete pipe, 42 lin. ft. 24 in. reinforced concrete pipe, 16 each, hauling and setting monuments.

DELAWARE

Bids will be received by the State Highway Department, at its office, Dover, Delaware, until June 13, 1923, for the construction of State Aid Highways, involving the following approximate quantities:

Contract No. CS21 5.17 Miles—Harbeson Milton—4 acres clearing, 2.00 acres grubbing, 27,000 cu. yd. excavation, 200 tons broken stone base course, 8,400 cu. yd. cement concrete pavement, 110 cu. yd. Class "A" concrete, 1,800 lbs. reinforcement, 630 lin. ft. 15 in. R. C. Pipe, 2,200 lin. ft. wire cable guard rail, 2,600 lin. ft. wood shoulder curb.

Contract No. CK10 8.90 Miles—Harrington-Burrsville — 3.83 acres clearing, 4.97 acres grubbing, 24,000 cu. yd. excavation, 25,000 cu. yd. borrow, 200 tons broken stone base course, 13,950 cu. yd. cement concrete pavement, 540 cu. yd. Class "A" concrete, 25,000 lbs. reinforcement, 30,250 lbs. structural steel, 1,800 lin. ft. 15 in. R. C. pipe, 1,900 lin. ft. wire cable guard rail, 2,300 lin. ft. wood shoulder curb, 1,500 lin. ft. timber piling.

Contract No. CK13 0.833 Miles—Houston to Milford-Harrington Road—2,400 cu. yd. excavation, 1,285 cu. yd. cement concrete pavement or 1,285 cu. yd. slag cement concrete, 10 cu. yd. Class "A" concrete, 140 lin. ft. 15 in. R. C. pipe.

Contract No. CS22 3.09 Miles—Frankford-Omar—10,000 cu. yd. excavation, 80 tons broken stone base course, 4,800 cu. yd. cement concrete pavement or 4,800 cu. yd. slag cement concrete pavement, 100 cu. yd. Class "A" concrete, 1,800 lbs. reinforcement, 600 lin. ft. wood shoulder curb.

Contract CS24 2.24 Miles—Dublin Hill-Bridgeville—6,800 cu. yd. excavation, 50 tons broken stone base course, 3,600 cu. yd. cement concrete pavement, 1,000 lbs. reinforcement, 380 lin. ft. wire cable guard rail, 500 lin. ft. wood shoulder curb.

IOWA

Bids will be received at the office of the county auditor, Atlantic, Iowa, until June 4, 1923, for 5,000 cu. yd. of excavation included in channel changes and approach fills to a 70-ft. pony truss.

Bids will be received at the office of the county auditor, Webster City, Iowa, until June 5, 1923, for gravel surfacing 5.79 miles of primary road from Webster City west to the county line, requiring 5,790 cu. yd. of gravel.

Bids will be received at the office of the county auditor, Anamosa, Iowa, until June 5, 1923, for three items of miscellaneous earth work, aggregating 6,300 cu. yd.

Bids will be received at the office of the county auditor, Hampton, Iowa, until June 6, 1923, for gravel surfacing and guard rail construction on approximately 12.02 miles of primary road, from the Wright County line east through Coulter, and from south of Hansell east to the Butler County line. Estimated quantities: 18,751 cu. yd. of gravel surfacing and 7,436 lin. ft. of guard rail.

Bids will be received at the office of the county auditor, Hampton, Iowa, until June 6, 1923, for graveling and guard rail construction on Primary Road No. 1. Estimated quantities: 4,875 cu. yd. gravel one mile haul, 15,125 units of additional half mile haul, 2,750 cu. yd. gravel crushed, 2,720 ft. type "C" guard rail, and 600 ft. of type "A" guard rail.

Bids will be received at the office of the county auditor, Hampton, Iowa, until June 6, 1923, for gravel surfacing two miles of township road included in Secondary Road District No. 17.

Bids will be received at the office of the county auditor, Leon, Iowa, until June 12, 1923, for grading and incidental work on 2,437 miles of primary road between Leon and the north county line. Estimated quantities: 35,141 cu. yd. of earth excavation, template yardage, 1,275 cu. yd. of farm entrance and cross road excavation, 925 lin. ft. of 6 in. tile drain, 5,880 lin. ft. of guard rail, 38,300 sta. yd. of overhaul, 80 lin. ft. of 15 in. culverts, and 256 lin. ft. of 18 in. culverts. Excavation work to be completed by November 1, 1923.

Bids will be received at the office of the county auditor, Hampton, Iowa, until June 6, 1923, for placing 700 cu. yd. of gravel per mile on 8¼ miles of county road from Chapin west. Bids will also be received for constructing 820 ft. of type "B" and 734 ft. of type "C" guard rail on county roads.

Bids will be received at the office of the county auditor, Leon, Iowa, until

June 12, 1923, for grading on 0.79 miles, involving 21,196 cu. yd. of excavation. Excavation work to be completed by November 1, 1923.

Bids will be received at the office of the county auditor, LeMars, Iowa, on June 12, 1923, for grading and draining 17.883 miles of the primary road from the Woodbury County line north. Estimated quantities, 267,217 cu. yd. earth excav. template yardage, 899 cu. yd. channel change, 1,008 lin. ft. 15 in. pipe culvert, 1,024 lin. ft. 18 in. pipe culvert, 304 lin. ft. 24 in. pipe culvert, 498 type "A" baffles, 37,103 lin. ft. of guard rail, and 415,000 sta. yd. of overhaul.

Bids will be received at the office of the county auditor, Sac City, Iowa, until June 12, 1923, for gravel surfacing 4.463 miles from Schaller west, involving 5,339 cu. yd. of gravel.

Bids will be received at the office of the county auditor, Sac City, Iowa, until June 12, 1923, for gravel surfacing 5.052 miles, located in Shaller, Early, Lake View, Wall Lake, Lytton, and Auburn. Estimated quantities, 7,881 cu. yd. of gravel.

Bids will be received at the office of the county auditor, Centerville, Iowa, until June 14, 1923, for maintenance tiling, etc., on Federal Aid Project No. 27. Estimated quantities, 3,200 ft. of 8 in. tile drain, and 3,700 ft. of 6 in. tile drain.

Bids will be received at the office of the county auditor, Centerville, Iowa, until June 14, 1923, for the following work:

Primary road northwest of Centerville, sections A and B, approximately 6.753 miles, involving 142,309 cu. yd. of earth excavation, 1,756 lin. ft. of 6 in. tile drain, 3,058 lin. ft. of 8 in. tile drain, 1,215 lin. ft. of 18 in. tile drain, 8 type B intakes, and 2 special intakes. The grading work is to be completed as follows: Section A, by October 15, 1923. Section B, between Sta. 206 and 320, by November 1, 1923, and the remainder by July 1, 1924.

Section C, on the primary road from Moulton north. Estimated quantities, 39,712 cu. yd. of earth excavation, 5,620 lin. ft. of guard rail, and 139 baffle walls. The grading work on Section C is to be completed by November 1, 1923.

Bids will be received at the office of the county auditor, Waverly, Iowa, until May 29, 1923, for placing 500 cu. yd. of gravel per mile on 3.68 miles of primary road from Waverly west.

Bids will be received at the office of the county auditor, Sioux City, Iowa, until May 29, 1923, for grading and incidental work on 16.21 miles of primary road from Moville east towards Correctionville. Estimated quantities: 243,404 cu. yd. earth excavation, template yardage, 2,500 cu. yd. farm entrance and cross road excavation, 1,525 cu. yd. of channel change, 75 ft. of 12 in. tile drain, 1 intake, 216 ft. of 15 in. corrugated culverts, 288 ft. of 18 in. and 32 ft. of 24 in. corrugated culverts.

Bids will be received at the office of the county auditor, Rockwell City, Iowa, until May 29, 1923, for gravel work as follows:

Secondary County Road No. 36, 5¼ miles, 1,500 cu. yd. per mile.

Secondary County Road No. 33, 5 miles, 1,500 cu. yd. per mile.

Secondary County Road No. 27, 3 miles, 1,500 cu. yd. per mile.

Secondary Township Road No. 26, 1¼ miles, 1,500 cu. yd. per mile.

Bids will be received at the office of the county auditor, Rockwell City, Iowa, until May 29, 1923, for 12½ miles of maintenance graveling on Primary Road No. 23, requiring 500 cu. yd. per mile. Also 9½ miles on Primary Roads Nos. 17 and 35.

Bids will be received at the office of the county auditor, Osage, Iowa, until May 29, 1923, for material and labor on 7,540 lin. ft. of type C guard rail, and gravel surfacing 13.175 miles of primary road west and northwest of Osage, requiring 20,553 cu. yd. of gravel.

Bids will be received at the office of the county auditor, Osage, Iowa, until May 29, 1923, for the construction of approximately 2,500 lin. ft. of type C guard rail on the primary road north and south of Osage. Bids are to be received for labor and material separately.

Bids will be received by the city of Lake City, until June 1, 1923, for 25,000 sq. yd. of pavement, 4,300 cu. yd. of excavation, 10,500 lin. ft. of curb and gutter, 600 lin. ft. of straight curb, and 11,000 lbs. cast iron intakes.

Bids will be received at the office of the county auditor, Albia, Iowa, until June 1, 1923, for 9.048 miles of road excavation from Albia northwest, involving 80,698 cu. yd. of excavation.

Bids will be received at the office of the county auditor, Albia, Iowa, until June 1, 1923, for 0.957 miles of excavation, involving 43,660 cu. yd. of excavation.

Bids will be received at the office of the county auditor, Leon, Iowa, until June 12, 1923, for grading on 0.79 miles, involving 21,196 cu. yd. of excavation. Excavation work to be completed by November 1, 1923.

Bids will be received at the office of the county auditor, Leon, Iowa, until June 12, 1923, for grading and incidental work on 2.437 miles of primary road between Leon and the north county line. Estimated quantities: 35,141 cu. yd. of earth excavation, template yardage, 1,275 cu. yd. of farm entrance and cross road excavation, 925 lin. ft. of 6 in. tile drain, 5,880 lin. ft. of 15 in. culverts, and 256 lin. ft. of 18 in. culverts. Excavation work to be completed by November 1, 1923.

MAINE

Bids addressed to the State Highway Commission, Augusta, Maine, will be received by the Commission at its office in the State House, Augusta, Maine, until May 31, 1923, for building 9 sections of state roads as follows: Concrete Surface, one section in Old Town, 2.245 miles. Bituminous Macadam Surface, one section in Bridgton, Moose Pond Bridge and Approaches, 0.587 miles. Bituminous Macadam or Gravel Surface, two sections as follows: Naples, 5.70 miles and Auburn, 3.05 miles. Gravel Surface, five sections as follows: Mercer, 3.37 miles; Monson, 2.10 miles; Smyrna, 2.16 miles, and Easton 3.21 miles. Readvertised; Edmunds, 2.78 miles. The work will consist of grading, drainage and surfacing.

MASSACHUSETTS

Bids will be received until June 12, by the Department of Public Works, Division of Highways, at its office, State House, for 22130 ft. of Bit. Mac. in Brimfield; 8 miles Sand Asphalt Mixture in Edgartown & W. Tisbury.

RHODE ISLAND

Bids for the construction of a section of State Highway in the towns of North Providence and Lincoln, beginning at a point on the Louisquisset Pike. 1500 feet northerly from Mineral Spring Avenue in North Providence and extending northerly on the Louisquisset Pike a distance of 3.13 miles, will be received by the State Board of Public Roads at its office, State House, Providence, R. I., until June 6, 1923. The principal estimated quantities are as follows: Contract 2304 Federal Aid Project No. 17, (Division A), excavation (earth & ledge) 16,000 cu. yd.; gravel foundation, 4,000 cu. yd.; pipe culverts, 1,200 lin. ft.; concrete masonry, 140 cu. yd.; wooden guard rail, 4,300 lin. ft.; reinforced cement concrete pavement, 7,342 cu. yd.; cement for concrete pavement 13,360 bbls.; galvanized steel fabric for pavement, 166,600 lbs.; steel bars for pavement 18,500 lbs.

NEW HAMPSHIRE

Bids will be received by the State Highway Commissioner at his office at Concord until June 5 for the following road work: Epping, bit. mac., 0.72 mi.; Alton, gravel, 0.76 mi.; Dublin, gravel, 1.15 mi.; Haverhill, mod. asphalt 1.33 mi.; Tilton, mod. asphalt, 1.61 mi. Plans and specifications may be seen at office of State Highway Commissioner, Concord. Frederic E. Everett, State Highway Commissioner.

IDAHO

Bids will be received at the office of the County Commissioners, Blackfoot, Idaho, until June 9, 1923, on the items below. Plans and detailed information

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The Importance of Highway Bridges to National Transportation

What New York State Is Doing To Solve The Problem

By DON HOLBROOK

WITH the ultimate system of the twelve thousand mile one hundred million dollar highway routes of New York State gradually nearing completion, the subject of its connecting bridges and carrying capacity naturally becomes of paramount interest. Just as the barge canal was built without much thought as to terminals and terminal facilities until it was nearing completion and the realization of its full usefulness was handicapped when completed by the lack of such facilities, so the failure of the state to adopt and carry into effect a definite bridge program now threatens to depreciate the full value of good roads for the transportation of the heavier loaded motor vehicles.

In 1915 the New York State Legislature awakened to the fact that some sort of action by it was necessary, and under a resolution adopted by the Legislature that year a committee was named of which the Hon. Charles O. Pratt, Assemblyman from Washington county, was chairman and directed "to inquire into the subject and condition of all bridges of the State outside of cities, and the method of construction and method and extent of maintenance thereof, together with the general sub-

A NEW YORK STATE HIGHWAY BRIDGE

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ject of the proper development of a uniform system of construction, improvement and maintenance of bridges, culverts and sluices in the State outside of cities, and to propose amendments to the statutes, especially the Highway Law, relating to such bridges, culverts and sluices."

This committee made an exhaustive survey of the bridge situation and handed down a report in the year 1919 which became Legislative Document No. 52, a digest of which follows:

The committee found that approximately 11,000 bridges, or one-third of the total number of bridges in the State had been constructed, reconstructed, improved and repaired under the provisions of present section 331 of the Highway Law reading:

"No town shall be liable for any damage resulting to person or property by reason of the breaking of any bridge, sluice or culvert, by transportation on the same of any traction engine, portable piece of machinery, or of any vehicle or load, together weighing eight tons or over, but any owner thereof or other person engaged in transporting or directing the same shall be liable for all damages resulting therefrom."

And that the remaining 22,000 bridges in the State were constructed before or while the provisions of the following laws were in force:

Chapter 526 of the laws of 1887:

"No town shall be liable for any damage resulting to a person or property by reason of the breaking of any bridge by a traction engine in crossing the same, of the weight of four tons or over, while such person is engaged in transporting or driving such engine along or upon any of the highways of this State."

REINFORCED CONCRETE BRIDGE BUILT BY TOWN SUPERINTENDENT IN CHAUTAUQUA COUNTY, NEW YORK

Chapter 210 of the laws of 1890:

"No town shall be liable for any damage resulting to a person or property, by reason of the breaking of any bridge by a traction engine of the weight of five tons or over exclusive of fuel and water contained therein in crossing the same, while such person is engaged in transporting or driving such engine along or upon any of the highways of this State."

Chapter 568, section 154 of the laws of 1890:

"No town shall be liable for any damages resulting to person and property, by reason of the breaking of any bridge, by transportation on the same, of any vehicle and load, together weighing four tons or over; but any owner of such vehicle or load, or other person engaged in transporting or driving the same over any bridge, shall be liable for all damages resulting therefrom."

For the purpose of classification and the best purpose of studying the question, the Committee divided the bridges of the State into three classes: Bridges located on State routes of which there were 1593; bridges located on improved county highways not included in State routes of which there were 1994; and bridges located on town and county roads of which there were 30,183. It was found that 67.4 per cent. of such bridges were from 5 to 20 ft. in span; 23.3 per cent. from 20 to 50 ft., and 9.3 per cent. over 50 ft. in span. These percentages hold about the average today.

An inspection of all bridges located on State routes and on county improved highways was made by representatives of the division engineers of the Highway Department as regards location, length, type, general condition and maintenance, type of foundation, condition of foundation, capacity or load (that is whether the bridge is able to safely carry a load of 15 tons), and much other information peculiar to each bridge.

The standard capacity of 15 tons was adopted and used by the committee in its inspection and classification because of four reasons: First, all bridges designed by the New York State Highway Department are designed for a 15-ton minimum capacity as a standard; second, the ever increasing heavy traffic which nearly all bridges of the State are required to sustain demands at least the 15-ton standard; and third, seventeen of the highway departments of other States have adopted a standard minimum capacity of at least 15 tons in designing bridges; fourth, after a bridge is constructed it is difficult and expensive to strengthen the structure in case it is not able to safely carry the traffic required.

A TWO-SPAN CONCRETE ARCH (EACH SPAN 75 FT.) IN SCHOHARIE COUNTY, NEW YORK

It was found impracticable to go into a detailed inspection of each of the 30,188 bridges located on town and county roads. It was ascertained, however, that 20,835 were of the span of from 5 to 20 ft.; 6906 were of the span of from 20 to 50 ft.; and 2447 were of the span of over 50 ft.

The committee found the general condition of bridges located upon town and county roads to be poor; the public using bridges unsafe and inadequate to serve traffic conditions; accidents resulting therefrom frequent, and, in many instances, maintenance wholly neglected. A great per cent. of this class of bridges were built under the so-called "Four Ton Law," when the standard requirement was for horse drawn traffic and as a rule towns have not seen fit to rebuild the longer structures to meet the present traffic conditions. Since the report of the committee was rendered, however, a number of town bridges have been replaced by modern structures where a town road has been improved under the Federal aid plan, but the percentage of town bridges at the present time in a dangerous condition is alarming in proportions.

Tables 1 and 2 show the number and carrying capacity of bridges on State routes and a total summary as to general condition and maintenance. These figures are as of January 1, 1916. Due to the failure of the State to adequately finance any definite program of repair and replacement, the number of bridges below standard have not been materially reduced. By amendments made to the highway law of 1917, however, plans and specifications for the construction of new bridges must have the approval of the Highway Department and the department requires the erection of a bridge of 15 tons capacity. This also holds true with all new bridges designed by the department and in repair of an old bridge whenever it is possible to do so.

A study of the classification and summaries in Tables 1 and 2 show that there were on January 1, 1916, 3587 bridges located upon State and county improved highway outside of cities, and that the length of all these structures is 117,402.71 ft., or an average length of 32.73 ft. for each bridge. Of this total number, 2499 bridges with a total length of 61,372.55 or an average length of 24.56 ft. per bridge, were estimated or computed to be safe for a 15-ton load. And, 1088 bridges with a total length of 56,030.16 or an average length of 31.5 ft. per bridge were estimated or computed to be not safe for a 15-ton load. This plainly shows that the longer bridges are less safe for heavy loads. The average length of structures not safe for a 15-ton load is over twice the length of those safe for a 15-ton load. The rule is, the longer the span, the more expensive is the structure which bridges the span. The fact is, the longer and what would be the more expensive bridges have not been replaced by adequate structures.

The Committee actually inspected 251 bridges located on three of the principal highway routes of the State. As to carrying capacity the Committee found 3 bridges which had been condemned; 5 bridges unsafe; 15 bridges good for 2½ tons or under; 10 bridges good for 3 tons; 7 bridges good for 3½ tons; 7 bridges good for 4 tons; 4 bridges good for 5 tons; 2 bridges good for 6 tons; 2 bridges good for 7 tons; 6 bridges good for 8 tons; 2 bridges good for 9 tons; 38 bridges good for 10 tons; 1 bridge good for 11 tons; 32 bridges good for 12 tons; 2

bridges good for 14 tons; 88 bridges good for 15 tons; 1 bridge good for 18 tons; 8 bridges good for 20 tons and 18 bridges good for 25 tons or over.

EASTON-GREENWICH BRIDGE AT CLARK'S MILLS, WASHINGTON COUNTY, NEW YORK

The towns of the State of New York have millions of dollars invested in bridge structures. A great per cent. of these structures are not of a permanent nature, such as stone or concrete with all steel encased or covered. Most of the longer spans are built of steel. Steel after the paint or preservative is removed from its surface begins to rust or decompose. This action occurs more in the creases, around rivets or in fact anywhere moisture is allowed to collect. Often a truss is placed and afterward all maintenance work is neglected; tension members are loose or strained and never adjusted; oftentimes refuse and debris is allowed to collect upon certain parts of the structure and the steel becomes rusted through and weakened and in a dangerous condition.

TABLE I. TOTAL NUMBER OF BRIDGES ON STATE ROUTES AND COUNTY IMPROVED HIGHWAYS CLASSIFIED AS TO SPAN AND CAPACITY

Span Ft.	15 Ton Capacity	Under 15 Ton Capacity	Total
5— 10	781	65	847
10— 20	891	223	1114
20— 50	590	419	1009
50—100	167	260	427
100—200	59	107	166
Over 200	11	13	24
Total			3587

Often a steel structure is noticeably well painted where it is in sight of the public, but the floor system and connections, which need preservation more than any other part of the structure, are allowed to go unprotected, due to lack of knowledge and care of the man having supervision of the work.

When the United States entered the war, the Council of National Defense, through its highway committee at Washington, made inquiry to the New York State Highway Department concerning the condition of all bridges upon its through improved highway routes across the State, with the intention of ascertaining whether or not motor truck transportation could be established from the inland cities to New York City to relieve the railroads. From information gathered by the Pratt Committee in its investigations, the Highway Department was advised of those bridges which were unsafe for the traffic intended; the Legislature appropriated $75,000 to be used in strengthening the bridges which were not safe to carry the traffic intended; and the weaker and unsafer structures were temporarily strengthened.

The Committee in its report recommended that all bridges of the State of New York be immediately constructed, repaired or improved to meet the conditions now demanded to safely carry all farm tractors, farm threshers, well drilling machinery, portable saw-mills, portable engines and boilers running same, auto trucks weighing 5 tons carrying loads of ten tons, moving vans, road rollers weighing not more than 15 tons, stone crushers weighing not more than 15 tons, traction engines and trailers weighing not more than 15 tons, steam shovels weighing not more than 15 tons, ditching machinery weighing not more than 15 tons, derricks and hoisting machinery.

The Committee found that in many States bridges are properly considered and treated as a part of the road; that is, improving the road means the improvement of the bridge, if necessary, to bring it up to the same standard as the road. There is no uniform method of construction, inspection or maintenance of bridges in this State. The town is the unit which bears the burden of expense with a few exceptions. There are many designs of bridges. The State Highway Department with its organization of expert engineers acts in an advisory capacity only. It may condemn bridges but it has no power to replace or cause to be replaced inadequate and unsafe structures. Table 3 gives the rule or law of various States in relation to capacity of bridges.

A REINFORCED CONCRETE BRIDGE OF GOOD DESIGN

The final recommendations of the report of the committee were:

Minimum Width of Roadway for Bridges. On State improved highway at least 20 ft. On county improved highway at least 18 ft. On town and county roads at least 16 ft. In case a bridge is located upon a town or county road likely to be improved, the width of roadway shall be according to the above recommendations.

Minimum Carrying Capacity. All concrete bridges upon State and county improved highway or upon highway proposed or likely to become State or county improved highway shall be designed in addition to the dead load, for a uniform live load of 150 lb. per sq. ft., and the floor system to sustain a 20-ton road roller. All steel bridges shall be designed in addition to the dead load, for a uniform live load of 100 lb. per sq. ft., and the floor system to sustain a 15-ton roller with a factor of safety. All other bridges shall be designed in addition to the dead load at least for a uniform live load of 100 lb. per sq. ft., and the floor system to sustain a 15-ton road roller, with a factor of safety.

TABLE 2. TOTAL SUMMARY AS TO GENERAL CONDITION AND MAINTENANCE OF BRIDGES ON STATE ROUTES AND COUNTY ROADS (IMPROVED)

Spans Ft.	Good	Fair	Poor
5— 10	795	68	32
10— 20	890	116	72
20— 50	701	165	127
50—100	227	101	103
100—200	103	43	22
Over 200	15		7

Standardization. Of plans and specifications. Of construction. Of inspection. Where sub-foundations and other conditions permit, bridges of a permanent nature should be constructed. All bridges shall be painted white or a combination of black and white, so that the structure may be easily discerned. Hereafter the State shall take over for maintenance, repair and re-construction, if necessary, all bridges located upon county and State improved highways. In other words, the bridges shall become a part of the road and be treated as such.

Organization. There shall be appointed by the New York State Commissioner of Highways a fourth deputy, who shall be a bridge engineer, and there shall be an organization built around him to carry on bridge work. He shall have general jurisdiction of all bridges and bridge work within the State outside of cities. He shall determine upon, prepare or cause to be prepared and kept on hand for distribution to the county bridge engineers standard plans and specifications for bridges of the various types which shall be determined by him. He shall have power to condemn and power to close to traffic, and cause to be replaced inadequate and unsafe bridges which are under his jurisdiction. He shall cause to be inspected annually, all bridges in the State under his jurisdiction. All bridges hereafter constructed, improved, maintained, repaired, etc., shall be a county charge, except as otherwise provided. There shall be appointed a competent bridge engineer for each county. County superintendent of highways may be appointed. He shall be responsible to the fourth deputy commissioner of highways. He shall have an organization for bridge work. He shall inspect all bridges within his jurisdiction annually, and he shall keep accurate data concerning each bridge on file in his office for information of the public. He shall supervise all construction and maintenance of bridges and keep accurate cost data concerning each bridge on file in his office for information of the public. He shall compute the actual carrying capacity of each bridge within his jurisdiction, and if a bridge is not safe for a 15-ton load he shall post in a conspicuous place upon the bridge its actual safe carrying capacity. He shall cooperate with the supervisor of a town, the board of supervisors and the town superintendent of highways. He shall inform the supervisor of each town as to the actual condition of each bridge within the town. He shall furnish plans and specifications for all bridges and bridge work. He shall have authority to call upon the town superintendent of highways for assistance at any and all times. The town superintendent of highways shall construct under the supervision of the county bridge engineer short span bridges and culverts. He shall publish each year a report for distribution to the public of all bridge work actually done and the expense thereof and the proposed bridge work contemplated for the ensuing year. The board of supervisors of the several counties of the State shall, at a meeting held in the fall preceding the year in which construction of bridges is to be done, determine upon a bridge program of construction, repair, maintenance, etc., for the ensuing year, and proceed to provide funds for the execution of such program. All bridges located upon State and county improved highway shall be numbered and the number placed upon the structure in some conspicuous place. If it is found upon inspection and computation that a bridge is not safe to sustain a 15-ton load such bridge shall be posted in a conspicuous place as to its safe carrying capacity, immediately after inspection. Bridges hereafter constructed over a stream forming the boundary line between counties shall be constructed at the joint expense of the adjoining counties, except as otherwise provided for.

TABLE 3. LEGAL CAPACITIES AND WIDTH OF BRIDGES IN VARIOUS STATES THROUGHOUT THE COUNTRY

State	State Ton	County Ton	Town Ton
California	15		
Connecticut	20		
Iowa (County is unit) county system all bridges		15	
Illinois	15	15	15
Kansas, county system		15	
Maine	12		
Maryland, two 24-ton trucks	48		
Massachusetts	20		
Michigan	15	15	15
Minnesota	20	20	20
New Hampshire (town system)	10		6
New Jersey	12½		
Ohio	15	15	
Oregon, county system in the main	—	15	—
Pennsylvania, rule of department handling bridges	20	12	12
Rhode Island	15		
Utah, rule of the department handling bridges	18		
Vermont	15		
Virginia	15		
Wisconsin	15	15	15

State	State Ft.	County Ft.	Town Ft.
California	21		
Connecticut	23		
Iowa (county is unit) county system		16	
Illinois	18	16	
Kansas (county is unit) county system		*18	*18
Maine	21		
Maryland	18		
Massachusetts	*24		
Michigan	16	16	16
Minnesota	16	16	16
New Hampshire (town as unit) town system	16	16	16
New Jersey	30		
Ohio	16	16	16
Oregon	16	*14-20	
Pennsylvania	*24	*16	*16
Rhode Island	20		
Utah	*16		
Vermont	21		
Virginia	12		
Wisconsin	16	14-16	14-16

* Rule.

TYPES OF OBSOLETE WOOD BRIDGES IN NEW YORK STATE

It was conservatively estimated that to carry into effect the recommendations of the committee and place all bridges in the State on a 15-ton capacity basis would entail a cost of from $30,000,000 to $35,000,000. Table 4 gives the amount expended for bridge construction and repair in connection with State and county highways from 1909 until the present date.

To bring the bridges of the State of New York up to a 15-ton standard at the average rate of construction during the years 1911 to 1918 inclusive it will take 14 years for bridges from 5 ft. to 20 ft. in span; or will take 33 years for bridges from 20 ft. to 50 ft. in span; and it will take 71 years for bridges above 50 ft. in span.

Some of the recommendations of the committee were adopted and enacted into law. A method has been provided for the condemnation of unsafe bridges and court procedure to compel their replacement. Standard plans and specifications for the construction of State and county highway bridges calling for 15-ton capacity bridges, have been provided by the highway department and plans for the construction of highway bridges are submitted to the highway department for approval and the plans of all bridges built in connection with rural post roads where Federal aid is extended must be so approved. The highway law has been so amended as to regulate the weight and distribution of the load of vehicles on highways and signs are posted on various bridges stating the tonnage capacity thereof. There is as yet, however, no centralized bureau or standard authority for the construction, repair, condemnation, reconstruction of all bridges of the State and the Legislature continues to pursue a desultory policy in the matter of appropriations.

Just what may be expected of the new administration is entirely problematical. Much has been put off until tomorrow by the preceding administration in the interests of economy. The charitable institutions of the State are overcrowded and the penal and educational institutions are crying for added accommodations, while the policy of the incoming administration toward the development of hydro-electric energy by the State and whether money for the carrying out of its scheme in this respect will be raised by appropriations or by bond issues will play a major part in the determination of a definite bridge program for the State and county highways, let alone the possibility of doing anything to remedy the truly scandalous condition of the town and county bridges. But one bond issue can be submitted at one general election for the approval of the people and so far it has been the policy of the State to provide for the construction of its barge canal and highways by bond issues for the most part. If a bond issue is determined upon for hydro-electric development, that would of course preclude the possibility of a bond issue being submitted at the same election for highway bridges. Neither is it logical to suppose that the Legislature having neglected a solution of the problem for so long would in one year attempt to cure it in its entirety either by appropriating the money necessary to extend over a period of years, as is done in the case of armory construction, or in one sum as was done to increase the pay of the school teachers in 1920. So that the best that can be expected is the appropriation at the next session of the Legislature, provided that body be in the proper frame of mind, of a few million dollars to patch up the most glaring defects in the bridge system with possibly another survey to report to the next Legislature.

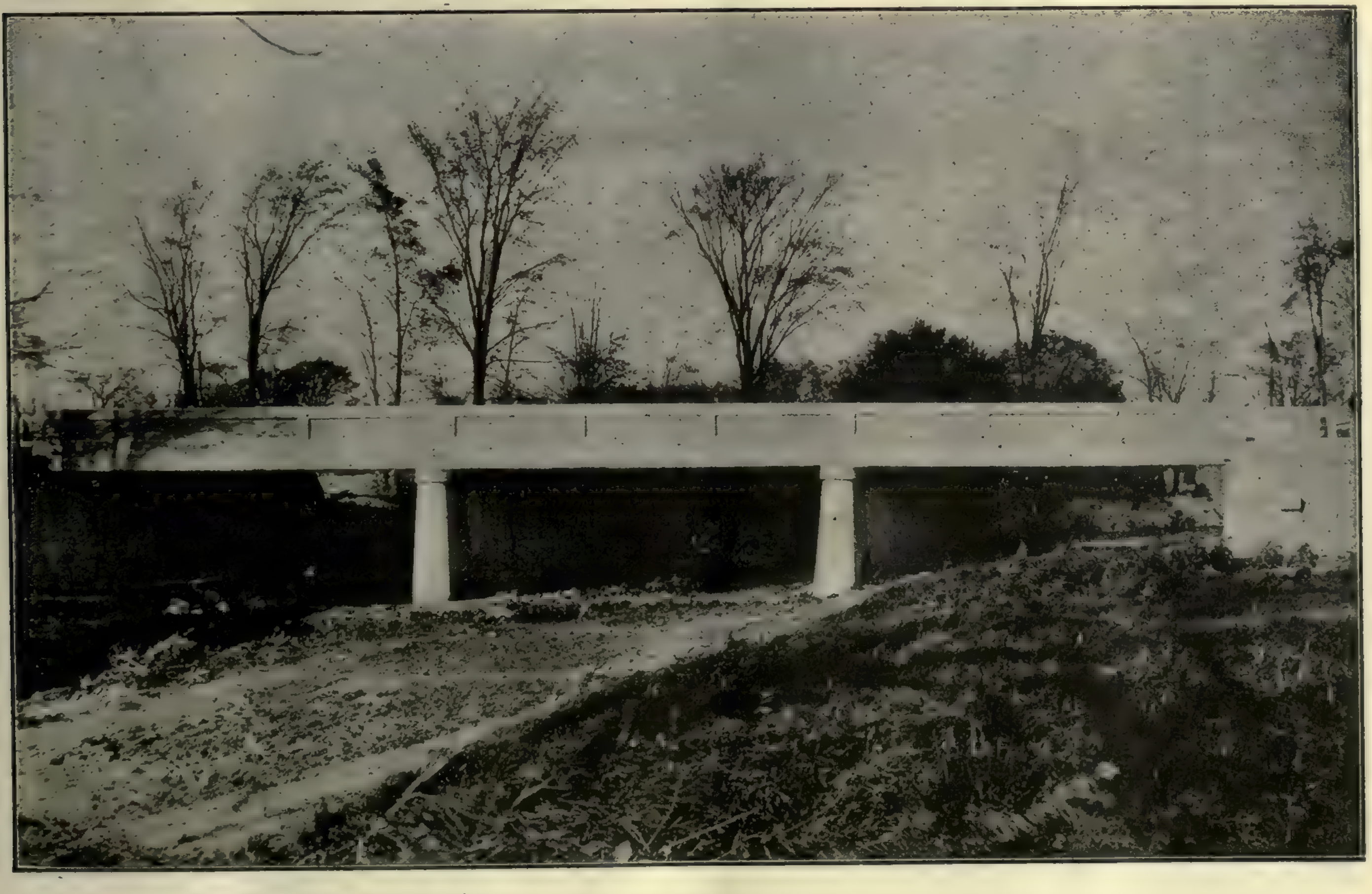
TABLE 4. AMOUNT EXPENDED IN NEW YORK STATE FOR BRIDGE CONSTRUCTION SINCE 1909

Year	Amount Expended	Construction of New Bridges	Repairs of Bridges
1909	$ 573,491.95	$203,772.61	$369,719.34
1910	822,318.12	370,365.63	451,952.49
1911	1,035,989.15	518,886.69	517,102.46
1912	970,926.56	508,822.82	462,103.74
1913	1,180,687.33	.546,676.15	634,011.18
1914	1,258,413.21	669,473.14	588,940.07
1915	1,301,596.03	Not separated after 1914.	
1916	1,360,436.27		
1917	1,225,676.60		
1918	1,135,079.41		
1919	1,226,396.71		
1920	2,949,252.30		
1921	2,421,366.71		

In addition to the bridges which form a part of the State highway system directly, there were at the time of the report of the Pratt Committee 1004 bridges crossing the old Erie and Barge canal under the supervision of the superintendent of public works. These bridges were divided as follows: 69 steel movable bridges; 187 steel fixed bridges (now permanent); 439 old type highway bridges; 309 old farm bridges, the latter running in most cases across the old canal from farm to farm and seldom used for public highway purposes.

Appropriations by the Legislature by general and

(*Continued on Page 219*)



The Economic Development of State Highways

Consideration of First Costs and Relation of Federal Aid

By THOMAS H. MacDONALD

Chief, U. S. Bureau of Public Roads

CONVINCED of the economic wisdom of improving our highways we have set our hands to the labor of building up a system of roads—state by state and county by county and the country as a whole. But just now there seems to be a period of hesitation or reluctance on the part of the public to carry the responsibility of continuing the work that has been well begun to its logical conclusion—the provision of an adequate system of highways for the ever increasing highway traffic. The suggestion is made in some quarters that we have gone far enough in building highways, and many other equally thoughtless comments and criticisms are more or less common.

It is precisely this typically American trait that is at the root of the greatest difficulties faced by highway officials today—the unwillingness on the part of the public, first, to ascertain the determining facts in the highway situation and, having done so, to use these facts as a guide governing the course of action until the desired objective—an improved system of roads—is reached.

To build these highways that are well nigh universally desired there is need of labor, material, organization, contractors, engineers, transportation of materials—all of which mean money. If we really want adequate highway service that money is absolutely essential. And yet it seems more than difficult to obtain from the public a general understanding of the tremendous effort that must be made in every state and in all the states to carry on the construction and maintenance of a sufficient mileage of highways to give adequate service.

A Policy of Publicity

Those in responsible charge of the road work in the states and Federal Government are making a serious effort to bring before the public a full statement of the need and a fair and complete disclosure of their activities in meeting the need. They are endeavoring to make perfectly plain the principles by which they are governed, and the reasons for the course of action they are following. And, all too frequently, this policy of openness and sincerity is taken advantage of, and the information so freely disclosed becomes the basis of attacks, unfair, unjust, and viciously destructive.

It has taken a long time and the road building efforts—successes and mistakes—of many states, to crystallize these principles, but they are now so clearly established that he who would deny them simply betrays his own lack of understanding of the definite progress which has been made in the science of highway administration, operation and financing.

It was for the purpose of encouraging the general adoption of these principles that the Federal Government in 1916, made its first appropriation for road building. The law is not an arbitrary set of rules and regulations, but rather a clear-cut delineation of the principles which have proved successful in application over a period of 30 years. These principles have not only proved successful in the states where they have been in effect for the longest period; they have proved, in fact the only methods that will insure a continuity of successful administration of the highways and produce both new construction and continuous maintenance suited to the needs of any state.

One of these principles, clearly established by experience, is that the economic development of the country calls for roads of four classes. Whether they are recognized as such or not there are roads of the four classes in every state and these classes are: First, the interstate roads; second, the roads which are of importance to a whole state; third, the roads of the county-wide importance; and fourth the local roads or roads which serve only one small community. As I say, the development of the country has already brought into existence roads of the four classes, and it is a first principle of proper highway administration to recognize the difference that exists. The roads should be grouped in their proper classes and the duty of constructing and maintaining each class should be acknowledged and accepted by the proper governmental unit. It is not right to expect, as we not infrequently have expected, the county to bear the expense of a highway which is actually of greater importance to the state than the county.

The "7 Per Cent." System

The existence of roads of interstate importance has been recognized by the Federal Highway Act and provision has been made for the segregation of such roads into an integral system, not exceeding in mileage 7 per cent of the total road mileage of the states, upon which funds appropriated by the Federal Government are to be spent in aid of construction. The interstate and state systems will generally be coincident, although probably not coextensive but there will generally be a clear line of demarcation between the state and county roads and the county and local roads.

There follows from the acceptance of such a classification the necessity for the establishment of an adequate state highway organization to take over the duty of building and maintaining the roads which are peculiarly the interest of the state, and this is another of the principles, developed through years of experience, that is recognized and given the force of law by the Federal Aid measure.

Now it is carrying the logic of the analysis only one step farther to set up as a third fundamental principle the idea that the roads, which are of importance to the state as a whole and which the state has provided an organization to administer, should be built and maintained with state funds derived from the citizens of the state at large. This principle also, has been adopted by the states which have recorded the greatest progress in highway development; but, in some states, it meets with resistance arising out of the conception of local self-government and the limitation of local responsibility to the improvement of local conditions. There is actually no conflict with the institution of local self-government. On the contrary this principle recognizes what I take to be an axiom of political economy: That improvements which benefit equally more than one locality or governmental unit should not be held to be the obligation of any one locality. The counties and smaller units have a great responsibility. There is imposed upon them the burden of maintaining the 90 per cent of all roads which are solely of local benefit. It is not right to expect them to build the main roads of the state which lie within their borders when, as is often the case, such roads afford greater service to communities outside of the county borders than to the county itself. It is not fair to exhaust the credit of the counties by expecting them to pay for roads the income from which will return only in part, in small part, perhaps, to their citizens.

Let me illustrate my point by referring to a certain county I know of, a county—not in this state—which is situated in a valley, surrounded by mountains. In order to obtain an outlet it bonded itself to the very limit and spent every cent of the money on a main line of highway. Its money spent and its credit exhausted, this county now finds itself with a road running through the center of it, but with no connection on either end, and there is no possibility of making these connections unless the state takes over the responsibility. The road is really a part of the main highway in that part of the state and it is the state's duty to take it over, reimburse the county for the money spent and connect it with the adjoining counties. It is not fair to place this burden on the county.

This principle was not included in the original Federal Aid Road Act, but it is now embodied in the Federal Highway Act, and hereafter it will be required of every state as a condition precedent to the granting of aid by the Federal Government that the state shall provide state funds under the control of its highway department to pay the state's part of the cost of constructing the Federal Aid roads and to maintain them perpetually when completed.

The First Essential

When, in recognition of these established principles, the highways have been classified according to use and a state highway organization, provided with state funds, has been created to care for the construction of the state roads, when the individual counties have thus been freed of the burden of providing the more expensive roads which are the concern of the entire state, the next problem is to determine the rate at which the improvement of all systems is to go forward, and in this there is involved directly the problem of financing the improvements.

But here let me say that there is this principle that may be set down as inevitable: That until a state has completed the back bone of its trunk line system with suitably paved or surfaced highways, the rate of construction should be independent of the source of the revenue or the method of payment, and should be limited only by the physical handicaps imposed by the available supply of labor and materials. Only by accepting this principle can the ultimate cost of the highways and their service be reduced. For, in a state like Virginia, the use of the principal highways is so extensive that the people pay for adequate highways whether they have them or not, and they pay less if they have them than if they have not. This statement can be very readily proved by considering the difference in the one item of fuel for motor vehicles on unimproved and improved highways.

Here is an example taken from an industrial section. The recent traffic counts made by the Bureau of Public Roads in Connecticut and Massachusetts, taken in October which is an average traffic month, show an average traffic passing each of four stations of 1140 tons of commodities per day of 9 hr. Adding one-third, as a very conservative estimate for the full day, we have 1520 gross tons daily commodity movement, which includes the weight of the commodity and the carrying vehicle. Now, from figures based on experiments conducted by the Iowa Experiment Station, assuming gasoline to cost 24 cents per gallon, the cost of fuel alone for moving this tonnage over an ordinary dirt road would be $26.44 per mile per day, assuming the impossible, that such traffic could be carried over a dirt road. The cost of fuel for moving the same tonnage over a paved road would be $11.70, a difference of $14.74 per day. On the basis of 300 days per year the actual saving in fuel alone for moving this tonnage would be $4022. Suppose the paved highway costs $40,000 per mile. The average interest at 5 per cent would then be $1000 per year, which, deducted from the saving of fuel, would leave a balance which would retire the cost of the road in a little over 11 years.

Here are the astonishing figures of the cost of an improved highway, constructed at prices which are above what we believe will be the general average of such costs, and the saving in fuel consumption alone on the commodity traffic, is sufficient to pay the cost of the construction, and the tremendous passenger traffic is carried, on this basis, free of cost.

With such facts as these before us, I think it must be agreed that until the trunk line systems are completed there can be no debate as to the wisdom of providing money for their construction. The question is: Are we going to pay for highways and get them or will we pay for them and not have them? There can be only one answer to that question.

But I do not mean to say that all highways, even of the trunk line system, should be paved. The type of improvement required is clearly dependent upon the traffic, and if the traffic be known, the kind of surfacing or pavement to be applied or whether to apply any surfacing at all will be a relatively simple matter to decide. It is merely a matter of balancing the aggregate saving in cost of operation, which is a product of the number of vehicles and the reduction in operating cost made possible by the various types of surface, against the costs of the several types of improvement. For any particular traffic density the economic type is that which can be paid for with the savings in operating cost accruing from the improvement. No road should be improved to an extent in excess of its earning capacity; but all roads should be developed to the highest degree consistent with the return in the form of traffic economies. Fortunately, we are not limited to any type of improvement. Our problem is to provide economical transportation, and in doing so we must resort to every material and every practice that can be utilized to obtain the end desired.

An Economic Problem

Nor do I mean to imply that every highway should be brought at once to its final state of improvement. We must keep always in mind that the amount of construction possible in any state is necessarily restricted by the physical limits of labor and material available. But in a state as large as Virginia there are miles upon miles of road to be improved, and every mile in an unimproved condition entails a reducible expense to the traffic that uses it. The ideal solution would be to improve all such roads at once, raising each to the state of improvement justified by its traffic, but this it is physically impossible to do. What, then, is the better course to pursue: To confine all attention to a few roads each year, leaving all others in a totally unimproved condition, or to extend the mileage treated and develop a whole system progressively by stages? We have learned by experience that the stage-improvement plan is the better. It is the only plan that has been successful in such a large state as

Virginia, and we have recognized the wisdom of it by advancing Federal Aid funds for improvements of this character. There will be certain roads of course, so important from the standpoint of traffic that they must be singled out for complete improvement at once, but generally speaking, the greater return will follow the simultaneous upbuilding of an entire system. In one state, with which I am very familiar the application of this method has made it possible to improve 1500 miles of secondary roads, surfaced with material available locally, which will last for a period of from five to ten years and which will greatly facilitate traffic during this period on the entire mileage improved. If the same resources had been applied to the construction of paved roads they would have produced only some 150 to 200 miles of pavement and the balance of the mileage would remain entirely unimproved.

I think there is no question that the improvement of the trunk line system should be carried into effect as rapidly as physical limitations will permit, and I have said that this should be done regardless of the methods of financing adopted; but I do not mean to imply that I regard the methods of financing as unimportant.

The Principles of Financing

Let us consider briefly the principles of financing. In the first place, it seems to me that there are only three sources of revenue, and whatever money is needed must come from one or more of them. One is the road user, from whom revenue may be derived in the form of automobile license fees or a gasoline tax; the second is property—real or personal—on which a direct tax may be collected; and the third is income. Then there are just two methods of expending the money derived from these sources, either by the pay-as-you-go plan or the deferred payment plan, which means a bond issue. Now, it seems to me that it is entirely possible, by following certain well known principles to finance a progressive program of highway improvement in this or any other state which will be acceptable to all parties.

The first of these principles which I would lay before you is this: That the total cash expenditures, in each state, for highway purposes shall be considered as the annual highway budget. You are building state roads and county roads and local roads, and the money to pay for all of them is derived finally from the same people. This being the case, unless you consider the financial needs of all classes of road in preparing your highway budget, you are very apt to pile up an expense which it will be impossible to meet without excessive taxation. In this connection there is a lesson to be drawn from your own experience. In planning the financing of your state system you are meeting with opposition to the issuance of bonds, and issuing them in considerable amounts. Since 1911 the state has issued $14,000,000 in bonds through the counties and practically all of these bonds are outstanding. Moreover, practically all of them are of the sinking-fund type, the most expensive type, and practically all of them have been issued to help build a state system for which the state ought to take the sole responsibility with the help it gets from the Federal Government.

If this policy is continued some of these counties that are issuing bonds will find themselves in the position of that county to which I have referred. With their credit exhausted and their people already taxed to the limit to build state roads they will be unable to perform their proper functions with regard to the county roads. The only way to prevent such a situation from developing is to provide the means with which the state may take over the responsibility which properly belong to it. And the business-like way to proceed is to recognize at the outset this first principle of successful financing which I have enunciated, set up a comprehensive budget which will cover the work for the year on all classes of roads and which will be adjusted to the people's ability to pay.

For the purpose of securing efficiency all expenditures on all systems should be correlated under engineering and economic supervision; and the order, character and extent of the improvements made upon the several systems should depend upon the relative future traffic requirements. The attainment of these objects implies the creation of a budgetary authority to supervise all highway expenditures in the state, and such an authority should, in my opinion, be created.

There is this fact also that we must constantly bear in mind: That the expenditure for highways is only a portion of the necessary public expenditure. We cannot take all the income from public revenue and devote it to highways. There are educational institutions to be maintained and there are other public functions that require money for their proper performance; and it may therefore be taken as another fundamental principle that the annual highway budget should be adjusted to the relative needs for other public purposes. The revenues derived from various sources must be sufficient to cover all these needs, and the portion allotted to highway improvements must not be out of proportion to the relative need for highways. But in this connection it should be added that all revenue secured from motor vehicles or road users should be set aside for highway purposes.

Now, if the highway program, planned and administered as I have described entails an expenditure greater than can be met with current funds without diverting money from other necessary purposes, the only recourse is to issue bonds, for I will remind you again that to fail to prosecute the work of highway improvement as rapidly as physical limitations will permit is merely to shoulder the inescapable expense in the form of greater operating costs for vehicles, a form in which it will be greater than if it is assumed as a road construction cost.

Deferred Payments

Exactly what part of the cost of the program can properly be deferred is perhaps a debatable question. That is to say, there is a debatable middle ground where it is difficult to define the policy that may be pursued with propriety. There is no question that certain parts of the construction cost may be deferred without reasonable objection; for example, the costs of the grade and drainage structures which are practically permanent improvements. On the other hand there is no question that maintenance charges as they are ordinarily defined should not be met with borrowed money. But in between these two fixed points of policy there is doubtful ground wherein it is difficult to judge offhand as to the soundness of deferring payment. The principal doubt arises over the financing of the cost of the pavement; and it seems to me that the solution of this doubt rests entirely with the character of the maintenance. It is probably the merest platitude to say that unless the roads are maintained year by year—it matters not how well they are built—the investment in them will gradually be dissipated and the roads themselves will never give the service that they should be expected to give. Perfect maintenance, on

(*Continued on Page* 218)

A New Impact Strain Gage

By E. B. SMITH

U. S. Bureau of Public Roads

THE strain gage described here was designed by the U. S. Bureau of Public Roads, the work on the development of which was begun during the summer of 1920. Since that time, several improvements have been made on the original construction. The primary consideration in the design of this strain gage was to secure an instrument which would respond to and accurately measure deformation resulting from suddenly applied forces and impact.

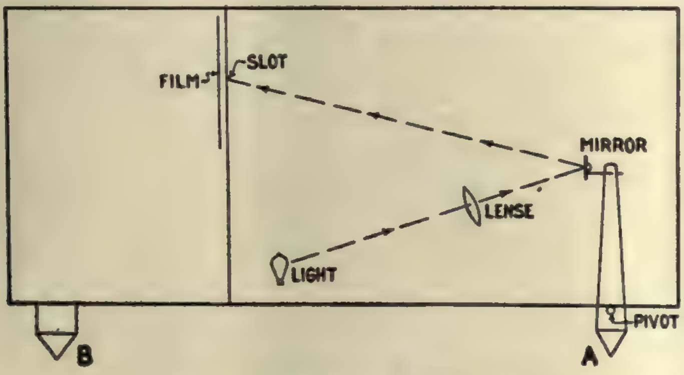


FIG. 1. PRINCIPLE OF THE GAGE

In the development of such an instrument it is important that a high degree of magnification of the deformation in any member to which it might be attached be attained. A magnification of from five to ten, or possibly twenty, was found to be too small. It was also realized that deformation occurring very quickly, say within one-half second of time and less, would require high velocities and accelerations in mechanical multiplying devices, and that the resulting lag and overthrow would so vitiate the records that they would not be dependable. The principle of optical levers was then resorted to and the instrument is based on this principle.

Principle of the Gage

The optical principle and essential features of this strain gage are shown diagrammatically in Fig. 1. A and B are the two gage points of the instrument, A being the movable gage point, pivoted as shown and operating at its upper end a mirror fixed on a pivot and bearing against the end. A source of light is focused by means of a small lens on the mirror and is reflected back to the film. In operation any slight movement of the gage point A will rock the small mirror about its pivot, thus deflecting the beam of light and magnifying very greatly the movement at A. By this means of magnification it will be seen that there are only two mechanical moving parts, namely, the gage point with its extension and the mirror on its pivot, and since the movement in either case is extremely small, they respond readily with very little inertia effect. The greater part of the magnification is attained by the movement of the reflected beam of light caused by movement of the mirror and this takes place with no inertia effect, consequently there can be no lag or over travel. To make the instrument recording a photographic film is so placed as to receive the record of the beam of light which passes through a slot of suitable size.

A photograph of the actual instrument is shown in Fig. 2, L being a small electric light bulb, the filament of which is focused through the lens on to the small mirror at N. The image of this filament is reflected back across the vertical slot located in the partition of the instrument at T. A roll of film is caused to pass this slot and receive the record. In the closed end of the box is a small electric motor, whose speed is reduced through a worm gear and serves as the driving power for the film. The motor and the electric lamp are operated from a 12-volt storage battery.

The films used in this instrument are the regular commercial vest-pocket kodak films which are 1 7-8 in. wide. For certain kinds of work a special set of spools may be provided on which may be wound motion picture films which will enable the operator to secure long records up to possibly 20 ft. in length.

Method of Calibration

It is possible to get magnifications with this instrument of more than five hundred. It has been found, however, that magnification of about 200 is ample for most cases. The instrument is calibrated by placing it on a specially constructed block whereby the movable gage point may be moved a known amount by means of a micrometer screw. This calibrating block is so constructed that the movable gage point may be operated slowly by hand or rapidly by means of an electric motor, so as to study the effect of rapid movements of the gage point. With the electric motor the gage point may be oscillated at a speed of about one hundred per second. The film record shown in Fig. 3 was taken by this instrument on the calibrating block. The total movement of the gage point during these trials was 0.003 of an inch; the speed of oscillation was varied from approximately 2 per sec. to about 100 per sec. This particular trial was made to determine whether there was any lag or overthrow of the instrument as shown on the record. Careful measurement of these original records indicates that the height of the record from top to bottom is the same for all speeds. The original magnification of these records was 250 to 1. The slow speed records show several variations and irregularities, but this was due to operating the calibrating device by hand rather than by motor, so any slight hesitation or variation of the speed was immediately shown on the record. Such tests of the instrument as shown by these calibration films indicate that the instrument is reliable and will give accurate records for all deformations up to about 100 per sec. In the case of bridge members where this in-

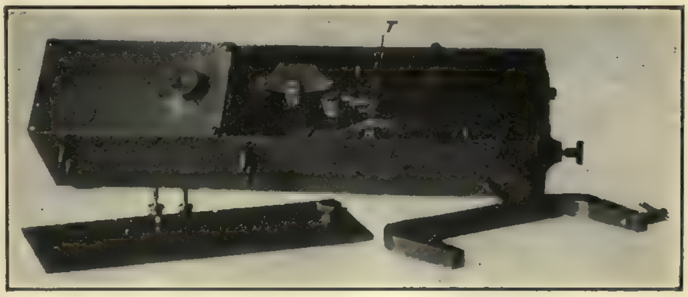


FIG. 2. THE IMPACT STRAIN GAGE

strument has been used, it has been found that the period of vibration of members is usually not more than 20 per sec. It is then quite easy to secure the deformation with each vibration as well as the maximum deformation caused by the impact of loads moving at high speed on bridges.

This instrument has been tried on the members of several highway bridges when the bridges are subjected to truck traffic running at various speeds, the resulting deformation being very accurately recorded on the film. These bridge trials, however, were primarily for the purpose of trying out the instrument rather than as a test of the bridge.

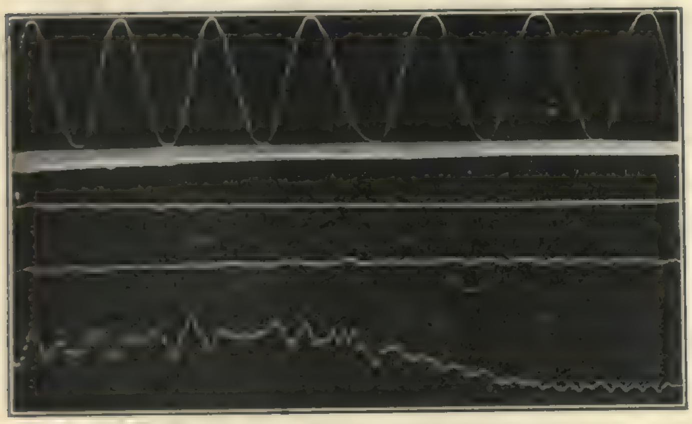


FIG. 3. TYPICAL RECORDS SECURED WITH NEW GAGE

There is shown in Fig. 3 several records of the trials taken on one of these bridges; a six-panel through Pratt truss on the lower cord. These records show the character of the records obtained at the different speeds of the 3-ton truck as it passed over the bridge.

Economic Development of Highways

(*Continued from Page* 216)

the other hand, absolutely guarantees the integrity of the original investment, assures continuous service and converts what would otherwise be a liability into an asset.

The State of New York has been severly criticized by a great many people because it issued several years ago $100,000,000 in bonds. Yet, I say to you that the highways purchased with that borrowed money are now worth probably twice $100,000,000 in actual replacement value. I think that is a very conservative statement; and, in addition the people of the State have had the service of the roads all these years. A lot of these roads are now being rebuilt, and it is true that the bonds issued have not been retired, but that does not mean that the people of the State will continue from now on to pay for an improvement that no longer exists as has been erroneously stated. The grades remain intact, and much even of the surfacing material remains to form the basis of the renewed surface. For example, on their macadam roads, originally surfaced 12 to 14 ft. in width, they are reshaping the surfacing material, drawing it toward the center to form a strip from 6 to 8 ft. wide and adding an 8 ft. strip of concrete on each side to form a pavement 22 to 24 ft. wide and the cost of the finished construction has been just about the average cost of an 18 ft. concrete road. So I repeat that whether you are to proceed on a pay-as-you-go policy or with funds derived from a bond issue is absolutely dependent upon the degree of protection you give the investment by maintenance.

Thus far I have not referred to the distribution of the financial burden, more than to suggest the sources from which funds may be derived. I have preferred to deal with the problem in three distinct parts to avoid the confusion which arises when one undertakes to discuss methods of payment and sources of revenue at the same time. I have shown: first, that the trunk line system, at least, should be completed as rapidly as possible, regardless of the method of pavement adopted or the sources from which the funds are obtained and that it should be limited only by the physical factors of labor and materials available; second, that the method of deferred payment is the logical resort when the funds necessary to carry on the requisite program are greater than may be obtained without undue burden from current tax collections. Now I am going to add that these points of policy will remain unchanged regardless of the distribution of the cost. Whether funds are obtained by taxation of property or road users should not affect the rate of improvement (at least for trunk line roads) and it has nothing to do with the method of payment adopted. I should like to emphasize that because you are being urged to adopt a gasoline tax in lieu of a bond issue, and I want you to understand that they are not alternatives. The one is a method of raising money; the other is a method of payment. And as I have already shown, your decision as to whether you will pay-as-you-go or defer the payment is dependent only upon the relation of the necessary rate of expenditure to the rate at which it is expedient to attempt to raise the money by taxation, regardless of the kind of taxation.

Now, viewing the problem of raising money as a separate matter there is one very definite principle that will aid you in determining upon a wise policy. Concisely stated, it is this: That the cost of building and maintaining an adequate system of highways should be distributed in equitable relation to the benefits derived.

I wish to develop this point very clearly and enumerate the various benefits derived because there is a tendency to saddle too much of the original cost of construction upon road users.

First and most important are the general benefits to society, such as the influences on education, recreation, health, the national defense, the postal service, living and distribution costs. In these, our general benefits, every man shares whether he rides in an automobile or not. Every one remembers the absolutely indispensable part played by the highways during the war. It is self evident that the efficiency of the rural free delivery postal service is dependent absolutely upon the condition of the roads. No one is so out of touch with developments in modern educational methods as not to know that the progress of rural education depends upon the displacement of the one-room school house by the centralized graded school and that this development in turn is dependent upon the improvement of the roads. The advantage of improved roads in making possible prompt medical attention in case of sickness is too well understood to be argued over. And so with the benefits that are derived by the farmer through increased participation in the facilities for recreation afforded by the town and the city and the general influence of the roads upon living and distribution costs. It is only necessary to mention these benefits for every one to realize how great an influence they have upon the lives of all of us.

A second important group is made up of the special benefits, such as those to agriculture, manufacturers, labor, railroads, waterways, mining and forestry. Without roads there could be no agricultural development at all. Without roads there would be practically no freight for railroads and ships to tansport. The need for roads to develop and protect our forests is so well understood that, as a nation, we are expending large sums of money for that special purpose. The advantage to manufacturers is two-fold—the roads facilitate the acquisition of raw material and aid in the distribution of the manufactured product. It is not necessary to go further in the development of the argument. It needs but a little reflection to convince one that every branch of industry is benefited directly because roads are built and maintained, and it follows that the economic improvement of the roads must increase these benefits.

The benefit to property is well understood, and the benefit to the road user is direct and obvious.

Now I say this: That all these benefits must be taken into consideration in making the assessment for the construction and maintenance of the roads. It is not fair to lay upon any one class a part of the cost disproportionate to the benefits it receives. And I will go further and say that when you are voting for highway bonds, it is not wise to obligate all the money that can be derived by taxation of the road user to pay the interest charges and retire the bonds. You will need money to maintain the roads when they are built; and it is especially appropriate to devote the money raised by taxation of the road user to this purpose, for two reasons: First, because it will be raised in direct proportion to the use of the roads and therefore in proportion to the need for maintenance; and second, because, once the rate is fixed, the return will be automatic, thereby assuring a continuing source of revenue for maintenance, which to be efficient, must be continuous.

I do not mean to say that no part of the revenue raised by taxation of the road user should be devoted to construction, but merely that from it there should first be set aside an amount sufficient to pay for maintenance and that the total revenue derived from this source should not be out of proportion to the benefits derived from the direct use of the roads. If a balance of such funds, fairly raised, remains after the maintenance requirements have been provided for, there can be no objection to applying it to construction.

The wide variation in the present status of highway development in the several states prevents the adoption of a uniform policy for securing the funds necessary to the annual highway budget and expending these funds. Generally speaking, however, these principles may be enunciated.

(a) States in the initial stage of highway development should issue bonds to defer that portion of the annual charge for construction which would overburden either property or the road user.

(b) States where original construction programs are well under way, can, in the main, finance further expenditures for construction by bond issues devoted to deferring the cost of special projects.

(c) States where original construction is practically completed are concerned chiefly with maintenance and reconstruction and should depend on current funds, save in cases of emergency.

(d) The maintenance of interstate and state roads should be a charge against the road user.

(e) Roads serving a purely local purpose will generally require only light upkeep and this should properly be a charge against the adjacent property, which in this case is the first and often the only beneficiary.

(f) No road should ever be improved to an extent in excess of its earning capacity. The return to the public in the form of economic transportation is the sole measure of the worth of such improvements.

San Francisco Completes First Unit of Famous 75 Mile "Skyline" Boulevard

The first completed unit of the 75 mile Skyline boulevard from San Francisco to Santa Cruz will be opened to traffic within the next thirty days, supervisor Richard J. Welch, chairman of Joint Highway Commission No. 1 in charge of the highway plans, announced.

In addition to providing an additional 5 mile unit for San Francisco's world famed scenic boulevard system, the opening of the first stretch of the new coast and mountain highway gives to local motorists a little more than a promise that actual progress is being made in the hard fought battle for another road down the peninsula.

Five miles of the progress stands as a concrete fact. Five or ten miles more will be added to this unit within the few months required to complete the construction work in progress on the second unit.

So important do municipal officials consider the nearing completion of this first unit of the Skyline road that arrangements have been made for the construction of a broad, safe intersection of the new highway with the existing junction of Great Highway and Sloat Boulevard at the ocean beach.

City Engineer M. M. O'Shaughnessy, to solve this traffic problem, having in mind the increase of traffic with the completion of the new road and the congestion of pedestrians with the construction of the outdoor playground and swimming pool south of the junction has designed a simple and safe intersection with subway passages for pedestrians.

For this purpose the Board of Supervisors has appropriated $15,000, and the intersection is expected to be completed in time for the opening of the first unit of the new boulevard to travel.

Highway Bridges and Transportation

(*Continued from Page 213*)

special laws for the construction and repair of bridges in connection with the barge canal and their removal from parts of the abandoned Erie canal have been much more liberal than for the highway bridges proper and the time probably will not be long distant when the greater part of these bridges will conform to a 15-ton capacity and practically all will be of modern construction. In the matter of old type highway bridges and farm bridges over abandoned sections of the old canal, it has become customary, where it is necessary to maintain a crossing to connect highways, to fill in the abandoned canal at the location of the bridge, as fast as the Legislature makes the necessary appropriations.

The bridges that are being built over the barge canal and the new construction in replacement of old structures represent the very highest type of bridge in the State or nation and are of sufficient carrying capacity to meet the requirements of the traffic to be handled.

A Correction

In the April 4 issue of "Good Roads," Table 1 on page 133 gave the capacity in cu. ft. per sec. of a 30-in. vitrified clay pipe as 22. This was an error, the correct value being 32 cu. ft. per sec.

Current Events in the Field of Highway Engineering and Transport

MONTANA GETS $342,000 FOR HIGHWAY CONSTRUCTION WORK

Expenditures totaling $342,000 of national forest highway funds for five roadbuilding projects in Montana have just been approved by the Secretary of Agriculture. This money was made available for roads serving the national forests and for roads within or adjacent to the forests which are of primary importance to States, counties and communities.

One of the projects calls for the construction of 10½ miles of road in Lincoln County between Warland and the end of the Federal Aid Highway. This project, for which $100,000 has been approved, lies within the Kootenai National Forest, and forms a link in the Libby-Rexford road. It is extremely important to the adjacent territory besides aiding in the administration and protection of the Kootenai Forest.

To add five miles to the Belton-Java road in the Flathead National Forest $100,000 has been authorized. This section will be 17 miles in length when completed according to the revised plans.

An additional $92,000 has been authorized for extending the present forest highway within the Gallatin National Forest 8 miles south to a point about 8 miles north of the Yellowstone National Park boundary. This added mileage is of considerable importance both to the public and the administration and protection of the forest. The reconstruction of the entire road to Yellowstone furnishes a very popular entrance to the park.

Construction of 5 miles of highway in Sanders County running west from Weeksville up one of the main east and west highways through Montana, has been authorized and $80,000 appropriated, $50,000 of which comes from the National Forest Highway funds, $24,000 from other Federal road funds, and $6,000 from local authorities. This road lies partly within the Cabinet National Forest.

For the purpose of making a location survey of 4 miles of the Yellowstone Canyon Highway the sum of $4,000 was authorized.

NEW FERRY SERVICE ACROSS THE HUDSON RIVER

On May 30th, the new ferry between Verplanck's Point (Peekskill) and Tompkins Cove was opened for traffic. The schedule calls for a 15-minute service. The "Bear Mountain Route" as it is called, affords a short cut between New York City, Westchester County and New England on the East, the Catskills, the Adirondacks, the Finger Lake region of Central New York, the Poconos, Delaware Water Gap, and Niagara Frontier on the West. The Bear Mountain Section of the famous Palisades Interstate Park is just above Tompkins Cove, western terminus of the new ferry line. Over $15,000,000 has been spent on its beautification and improvement. Bear Mountain is reached from the ferry landing via the Henry Hudson Drive. West Point and the superb Storm King Road, are but a few miles north of Bear Mountain.

WASHINGTON ROADS GET AID FROM NATIONAL FOREST FUNDS

Expenditures totaling $210,000 of national forest highway funds for four road-building projects in Washington have just been approved by Secretary of Agriculture Wallace. This money was made available for roads serving the national forests and for roads within or adjacent to the forests which are of primary importance to States, counties and communities.

One of the projects in question is in Blewett Pass, Kittitas County, where 2½ miles of road will be constructed between Ingles Creek and the boundary of the Wenatchee National Forest. An allotment of $60,000 has been approved for this work. This is additional to $160,000 heretofore authorized for the construction of a little over 10 miles of highway extending from the Sunset Highway to the end of the road at Mt. Home.

Another one of the projects is a new bridge on the Olympic Highway across the Bogachiel River in Clallam County adjacent to the Olympic National Forest, for which purpose expenditures of $50,000 have been authorized. A bridge is required at this point for the southward extension of the new highway now being built in this neighborhood.

An additional $50,000 has been approved for the construction of 10 miles of road in Ferry County extending southward from Laurier. This road is adjacent to the Colville National Forest. Including this last appropriation of $50,000, a total of $200,000, half furnished by the State and half by the Federal Government, has been authorized for this 10 mile project.

A new project called the Randle-Yakima road received an allotment of $50,000. This new road will extend from Randle to a point 3 miles east. It is within Lewis County and serves the Rainier National Forest.

STANDARD OIL TO AID ROAD BUILDING IN INDIANA

The Standard Oil Company of Indiana has informed Governor McCray that it will meet the motorists of the state half way in the payment of the 2 cent tax on gasoline which becomes effective Friday, June 1, by increasing the price of gasoline only 1 cent a gallon instead of 2 cents.

The Oil company says in its announce-

(*Continued on Page 221*)

PENNSYLVANIA FACES LOSS OF $20,000,000 FOR ROADS

According to Highway Commissioner Paul D. Wright the Pennsylvania Highway Department during the next two years will have total revenues $20,000,000 less than its actual requirements, even though the legislature allows the department to retain the $11,000,000 appropriations made in previous years, but never paid because of insufficient revenue. If the legislature lapses the $11,000,000 appropriations referred to, the department revenues for the next two years will be $31,000,000 less than the requirements. It has been suggested the legislature drop from the general appropriation bill $1,000,000 allotted the State Highway Department for the next two years for general salary and expenses; and if this is done, the revenues will be $32,000,000 less than the requirements.

"It will be unfortunate if the legislature thus handicaps the State Highway Department," said Commissioner Wright recently. "The state is just beginning to find daylight through the bad-roads tunnel. But the Commonwealth must not lessen its road-building activities until the state has all the durable highways it requires. This is not a summer's job—it will mean strenuous activity for years to come. A thousand miles of highway on the Primary System are totally unimproved. There are many miles of so-called improved roads on that System which are of such type their maintenance under modern traffic is a tremendous expense. This mileage must be replaced by the department with modern roads. Pennsylvania has been pointing to its road-building activities. It cannot afford to lose its place in the van of progressive American states."

Appropriations made by the 1917, 1919 and 1921 legislatures, and never paid to the department because of insufficient revenue in the State Treasury, totalled as follows: State Highway Construction, $6,650,000; State-aid Highway Construction, $6 650,000; State-aid Maintenance and Repairs, $240,000; Borough-aid Maintenance and Repairs, $285,000. This is a total of $10,875,000.

The State Highway Commissioner estimates the amount of money necessary annually for the department's proposed program is $36,830,000. The estimated annual revenue for the next two years, he said, is $26,387 500, or $52,775,000 for the two years, as compared with requirements of $73,660,000 for the next two years.

"We are talking in large figures," said the Highway Commissioner, "but these figures are not nearly so large as the proposition which confronts us." The department's estimated revenues for the next two years are as follows:

One-half of old appropriations to be used first year, $5,437,500; State Bond Road Fund (½ of $900,000), $450,000; Motor License Fees, $16,375,000; Increase (available only if increases in House Bill No. 1179 are authorized by Legislature), $1,125,000; Federal Aid (available only if met approximately 2 to 1), $2,500,000; Appropriation, Session of 1923 (available only if $1,000,000 appropriation is favorably acted upon), $500,000. Total Estimated Revenues, $26,387,500.

(*Continued from Page 220*)

ment that it is willing to assist in the program of state road building by this means since the money to be raised by the tax is to go for improvement of Indiana roads. Officials of the company estimate that by paying this portion of the tax, it will be contributing upwards of $200,000 for the upkeep of the state roads.

Governor McCray said he had expected the oil companies to share in the payment of the tax as such policies had been adopted by other states. The Governor has held a number of conferences with officials of the oil companies in an effort to induce them to take this step. J. C. Marshall, of Indianapolis, manager of the Standard company and Vice-President Jackson of Chicago made known the decison of the company to the Governor Tuesday.

THREE CENTS GASOLINE TAX IN FLORIDA

Gov. Hardee of Florida has just signed a measure passed by the legislature increasing the tax on gasoline from one to three cents a gallon. One of which will mean $750,000 more revenue annually for the state road department. The counties will get the third cent. The road department now enjoys approximately $750,000 annually from the cent it has been receiving. All told the future annual revenues of that department are expected to reach approximately $4,500,000.

GAINESVILLE HIGH SCHOOL STUDENT WINS FLORIDA GOOD ROADS ESSAY CONTEST

First place among the Florida High School students, entered in the national good roads' contest, has been won by Addie Muller, of Osteen, attending the Sanford High School. Miss Muller's essay will be entered in the national contest in competition with the best essay from each of the other states for the $4,000 H. S. Firestone university scholarship which provides for tuition and all reasonable expenses for a four-years' course at any college or university, chosen by the successful candidate. All the essays were written on the subject, The Influence of Highway Transport Upon the Religious Life of My Community, and practically every high school in the state was represented in the contest. Each high school had the privilege of sending in the best three essays from which the winner in the state contest was chosen.

In the Florida contest, second place went to Norman Chamberlain, of Miami High School, Miami Beach; third place, to George Kerr Armes, Jr., of Leon High School, Tallahassee; fourth place, to Richard N. Merrill, Jr., of Miami High School, Miami.

JACKSONVILLE-TALLAHASSEE ROAD OPENING CELEBRATION TO BE HELD JUNE 30 IN LAKE CITY

Plans for the celebration of the opening of the Jacksonville-Tallahassee road at Lake City are now speeding ahead, Dr. M. B. Herlong, president of the Florida League of Municipalities and director general of the event, recently announced. Saturday, June 30, has been set as the date, Dr. Herlong said. Invitations have been extended to the four Gubernatorial candidates now in the field, Mayor John W. Martin, Judge C. B. Parkhill, Congressman Frank Clark and Frank Jennings, and Representative Frank O. Miller, good roads booster, has also been asked to speak. A baseball game between the Jacksonville All-Stars and the Lake City Sand Spurs is also planned.

ROAD BONDS OF $120,000 TO BE ISSUED BY FLORIDA

The legislature this week created the Lake Helen-Osteen road and bridge district and plans are now on foot to bond the newly created district for $120,000 with which to build one of the finest highways in this part of the state. The new highway will run in a fairly straight line from the end of DeLand-Lake Helen brick highway to Osteen and there connect up with the highways leading in from New Smyrna on the East and Enterprise on the West. This new road is expected to open up some of the best orange land in the county and to become a popular drive as it will pass the shores of three beautiful lakes.

UNITED STATES CIVIL SERVICE EXAMINATION FOR HIGHWAY BRIDGE ENGINEER TO CLOSE ON JUNE 26TH

The United States Civil Service Commission announces an open competitive examination for highway bridge engineer. Vacancies in the Bureau of Public Roads, Department of Agriculture, for duty in the field, at $2,400 to $3,600 a year, and in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

The duties of this position involve superintending the construction of bridges of various types throughout the United States and cooperating with state highway departments in connection with the provisions of the Federal Highway Act. In addition, the duties of appointees will be the inspection of bridges and investigation of bridge building material, administrative organization, methods of management, and giving advice in regard to bridge improvement. The work will also include the making of surveys of bridge sites, design and preparation of plans for bridges, and the review of such plans and specifications. Competitors will not be required to report for examination at any place, but will be rated on the following subjects, which will have the relative weights indicated: 1. Education and preliminary and general experience, 45; 2. Special experience and fitness, 55.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the Secretary of the United States Civil Service Board, Customhouse, Boston, Mass., New York, N. Y., New Orleans, La., Honolulu, Hawaii; Post Office, Philadelphia, Pa., Atlanta, Ga., Cincinnati, Ohio, Chicago, Ill., St. Paul, Minn., Seattle, Wash., San Francisco, Calif., Denver, Colo.; Old Customhouse, St. Louis, Mo.: Administration Building, Balboa Heights, Canal Zone; or to the Chairman of the Porto Rican Civil Service Commission, San Juan, P. R.

VARIETIES OF ASPHALT REDUCED TO 10

In a meeting of producers and consumers of asphalt held on May 28th at the Department of Commerce, Washington, D. C., the 88 varieties of asphalt used for paving purposes were reduced to 9, and 14 varieties used as brick and stone block, fillers were cut to 4. Since 3 of the grades adopted for fillers are identical with 3 of those adopted for paving use, the actual reduction is from 102 to 10, or practically a 90 per cent. elimination. One manufacturer stated to William A. Durgin, Chief of the Department of Commerce Division of Simplified Practice, "had this simplification been effected a year ago it would have saved our company over $200,000." Durgin pointed out that there are 22 firms within the United States in this business.

The meeting was the outgrowth of a preliminary conference of producers on April 24, 1923, called at their request by the Division of Simplified Practice which is cooperating with various industries in their efforts to reduce waste by eliminating superfluous varieties. At the first meeting the producers volunteered to send to the Department statements covering their individual shipments for 1922 of various grades of asphalt, as defined by penetration limits. This was done and the summary showed that 81 per cent. of their 1922 shipments in 388 varieties fell within the 9 grades included in the tentative specifications of the American Society for Testing Materials. The other 19 per cent. of the total tonnage was outside these grades.

After brief discussion the above action was taken. The producers were represented by delegates from the Asphalt Association, and also by representatives from asphalt companies not members of the Association. The consumers were represented by engineers and other officials from various state and city highway departments.

The conference unanimously agreed that grades of asphalt used in construction of sheet asphalt, asphaltic concrete, and asphalt macadam, pavements, and also for surface treatment should be reduced to the 9 grades having the following penetration limits:

25 to 30
30 to 40
40 to 50
50 to 60
60 to 70
85 to 100
100 to 120
120 to 150
150 to 200

In adopting these limits, it is understood that the producer will furnish asphalts with penetration equal to the mid-point in each range, a plus-and-minus tolerance from that mid-point being acceptable to all parties, but in no case shall the deviation from the mid-point exceed the limits of the grade specified.

By way of explanation, the consistency of asphalt is measured by "penetration." This means the distance a standard needle will sink into a sample of asphalt when the asphalt is maintained at 77 degrees Fahrenheit, and the needle is operated under a load of 100 grams for 5 seconds. Each "point of penetration" represents the movement of the needle through 1/100 of a centimeter, or approximately 1/254 of an inch. This is the standard test of the American Society for Testing Materials, and has been adopted as a tentative American standard by the American Engineering Standards Committee.

The conference also unanimously adopted 4 grades of joint filler for various types of construction—30-50, 50-60, 60-70, and 85-100. The first is used primarily for brick pavements and does not require admixture with sand, whereas the latter three, which are identical with three of the grades adopted for asphalt pavement construction, are those which would ordinarily be used in admixture with sand to produce an asphalt grout.

This gives a total of 10 grades by penetration limits for asphalt used in construction and treatment of roads and pavements. It is the hope and expectation of all present that this reduction in variety will bring notable economies in the production, sale, and use of asphalt, all of which in due time means to the taxpayer "more miles of highway per dollar spent."

It was further agreed that this elimination should become effective in all deliveries made after January 1, 1924.

Equipment — Trade — Materials

CHAUSSE OIL BURNER SURFACE HEATER

Shortage of labor for street and highway repair work has caused considerable interest in the return to production of the Chausse oil burning apparatus for repairing asphalt streets with greater efficiency and economy than is experienced through the use of manual labor only. The wide necessity for increased economical maintenance of asphalt pavements, the advantage of hot patching over cold patches and the saving of both time and money secured by the use of improved machinery has focused attention on apparatus for rapid street repairing.

About five years ago Chausse machines were introduced to street highway departments and through two years of production made enviable records. With improvements made in these machines, ample production facilities and a record of success behind them the Chausse oil burning tool and surface heaters have been returned to active distribution. The accompanying illustration shows Chausse surface heaters which are used in a great number of cities and by a large number of contractors. The new features of these machines combine meritorious features of the old apparatus with refinements which have been found desirable.

Chausse surface heaters are made in two sizes, one to cover 2 square yards and to work up to street car tracks without interfering with car movements. The other covers 4 square yards and both machines are mounted on springs to prevent damage in transit and both fold up to facilitate transportation. The cutting edges all around the burner hood give clean straight joints and it has been found possible in actual service to melt down old asphalt to 1 in. depth in 4 to 5 minutes. As much as 600 square yards of asphalt has been heated to a 1 in. depth in an 8-hour day. In the City of Detroit one Chausse surface heater and 2 men were able to do the work of 4 men chopping out and at the same time saved 1 in. of asphalt and 1 1-8 in. of binder in addition. Hand chopping meant taking out everything right down to the base so that the Chausse machine saves both labor and material and in the completion of approximately 80,000 square yards of asphalt repairing the Chausse heater reduced the cost from $1.23 to 97c per square yard.

These machines are now being offered to the trade by the Chausse Oil Burner Company with offices at 206 Lincoln Building, Detroit, Michigan.

NEW McMYLER-INTERSTATE CRANE

The McMyler-Interstate Co. of Cleveland, Ohio, have recently issued a new bulletin, giving specifications and photographs of their No. 2 steam operated convertible crane. This crane is distinctively a new McMyler-Interstate product. It is a complete standard locomotive crane in every sense of the word and is the smallest of the several types built.

The adaptability of this crane is indicated by recent purchasers who include coal companies, sand and gravel companies, manufacturing companies and construction contractors.

Construction that is sturdy and generous in every detail also makes this crane one that will stand up under hard work, day in and day out, allowing the operator full time to devote to production. The travel base and the turntable are heavy box-section steel castings. All of the gears above the turntable are cut steel. The turntable rollers and their shafts are one-piece hardened steel forgings. All bearings have large, renewable bronze bushings. The frictions are all oversize assuring flexibility of control and long wearing qualities.

In designing this crane full appreciation has been given to the desirability of having all parts of the mechanism readily accessible for adjustments and repairs. Practically every part of the crane subject to wear may be taken down by removing a set of bearing caps. The frictions may be relined without disturbing any of the mechanism. The few adjustments on the crane are within easy reach of the operator.

The crawlers on this crane are of patented design and embody features which give a uniform drive over the entire face of the crawler treads, giving great stability while traveling and eliminating possibility of tooth breakage or of the treads jumping the sprocket wheels. The crawler treads form a continuous steel track for the eight hardened steel rollers. An adjustment screw is provided to take up any slack which may develop in the treads.

All steering is accomplished under any conditions by the crane operator from his platform in the cab, without the assistance of a ground man to throw clutches or to hook up steering arms. By throwing a hand lever and swinging the crane in the desired direction of travel, the machine is easily steered about curves and sharp corners. If desired, the crane may be pivoted on one crawler. Of especial importance is the fact that the crane may be steered in any direction irrespective of the relative position of the cab and the running gear. This feature is essential when traveling with a load.

In addition to handling various bucket and line work, this McMyler-Interstate No. 2 Crawler Crane may be readily converted in the field to a ¾ yard steam shovel. An attachment for driving piles is also available.

Besides the crawler mounting, this crane may be mounted on traction wheels or on a standard guage railroad car body.

C. L. BEST TRACTOR ISSUES BOOKLET "SUBBING THE SOIL"

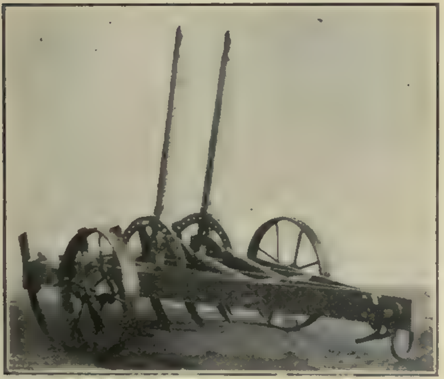
Subsoiling is becoming increasingly popular in most sections of California, and it is highly profitable where intelligently done. Outside of California, however, there seems to be little known of the immense possibilities of deep tillage, and many seem to confuse deep tillage or subsoiling with deep plowing. The study of the benefit derived from the deep tillage of soils has aroused a keen interest in the subject, and yet there have been very few printed documents which could be considered authoritative.

With the sincere belief that the agricultural interest of the country would find value in a booket which dealt broadly with this subject and without bias, the C. L. Best Tractor Co. has accumulated all the data which it could on the subject, and has prepared it in the form of a booklet called "Subbing the Soil" in the hope that knowledge of what is so evidently a good thing, will spread.

Throughout this entire treatise, it has been the fixed purpose of the company to let the other fellow "tell the story." This permits the broad unprejudiced treatment which such a subject deserves. The wide spread acceptance and practice of deep tillage means the demand for ample tractive power to pull deep tillage implements—and this company builds Best Tractors particularly suited for the arduous demands of deep tillage.

LAKEWOOD GRADEROOTER

The Lakewood Graderooter illustrated is a new piece of paving equipment brought out by The Lakewood Engineering Company, Cleveland, Ohio, that has already attracted considerable attention. It has been found particularly useful in scarifying subgrade preliminary to mechanical subgrading. It is used also for practically all of the scarifying work found on the average road job, and is built very heavy to stand up under severe service. Some contractors are using this in place of a rooter plow. It is also being used for maintenance work by state as well as county highway departments.



The Graderooter is furnished with two sets of five teeth each, and one special manganese tooth alone for particularly heavy work. Machine weighs about 1300-lbs. and can be furnished for tractor or team hitch.

NEW PUBLICATIONS

"Smith Excavator and Loader" is the title of an attractive, 20-page, two-color catalog just issued by The T. L. Smith Company of Milwaukee. In addition to the usual description, illustrations, and specifications of the excavator and loader, there are several pages devoted to the five uses for which the machine is designed, namely:

1—Basements and general excavating and loading.

2—Bank excavating and loading of gravel, sand, etc.

3—Stock pile loading of gravel, sand, coal, etc.

4—Stripping of sand, gravel, clay and rock.

5—Grading of alleys, streets and general work.

The new catalog also contains facsimiles of a number of letters from contractors who own and operate Smith Excavators and Loaders, together with illustrations of the machines on typical jobs.

"Caterpillar Tractor Performance" is the title of a booklet published by the Holt Manufacturing Company, Peoria, Ill. The book contains numerous photographs showing the Caterpillar tractors under working conditions, and also specifications of the various types of Caterpillar tractors.

Catalogue 405-C has just been issued by the T. L. Smith company, Milwaukee. It describes the non-tilting type of Smith concrete mixers.

"Upholding the Business End" is the title of an illustrated folder issued by the Thew Shovel company, Lorain, O., and the foreword points out that the boom may be perfect in performance and may be backed by good engines and mechanism; but if it is not upheld by the right kind of a truck the investment in such a shovel is lost. The folder presents in a clear and concise way the facts about the Thew truck.

The Pawling & Harnischfeger company, Milwaukee manufacturers of cranes and excavators, has issued new bulletins features P & H excavating equipment. Their 58-X Bulletin features the clamshall, dragline, orange peel, backfiller, crane hook, electromagnet and pile-driving rig, with which the P & H excavators may be equipped. The 16-X Bulletin features P & H trenching machinery. Their Testimonial Bulletin is made up of letters written by users of P & H machinery.

THE AUSTIN PUP

The Austin Pup is the most valuable piece of all-around road machinery that has been brought into existence for many years. It is a three-wheeled power roller of sturdy design and ample power, of three tons weight which can be increased to three and one-half or four tons. It is also a road maintainer for keeping gravel or dirt roads in good condition; and on special orders is furnished with a scarifier attachment for breaking up roads too hard for its blade to penetrate.

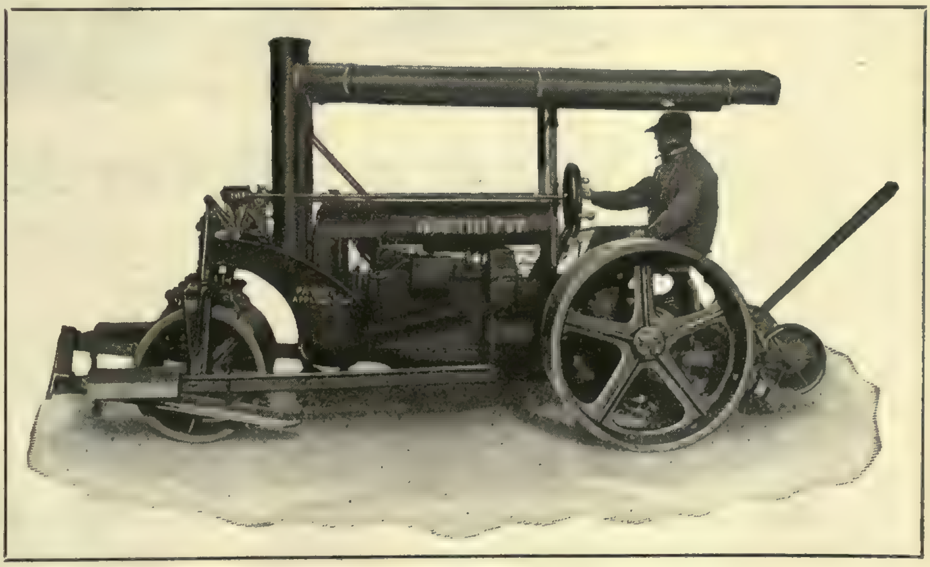
As a roller, it was brought into existence by the specifications for concrete roads built under the direction of the Illinois State Highway Department, which call for a three-ton power roller. Heretofore, there has been nothing of such light weight obtainable except the old style three-ton Tandem type of roller which could only be used in a limited way and cost nearly as much as a full-sized one.

The Austin Pup is the first three-wheeled power roller weighing less than seven tons.

Concrete road contractors will find the Pup of great use for preparing the subgrade by bringing it to a true surface and saving the unnecessary outlay of concrete that would otherwise go to fill the depressions in the road. It can also be used as a regular little tractor, as it has ample power, and will pull a wheeled or drag scraper or fresno, or a small road machine, or a plow; and in fact will do anything and everything that a little tractor will do; and at the same time it is a very practical and complete road roller, which no tractor is. Spuds are provided for the rear wheels to be used when increased traction is necessary just as is done with large rollers, and a special foot brake is also provided for use primarily when changing gears on hills.

One Highway Department is adopting the Pup for rolling stone chips into the tar covering of a re-dressed macadam road. Another department finds that it answers perfectly for making repairs on bituminous concrete and other bituminous type roads.

Regular equipment on the Austin Pup includes the planing blade, but not the scarifier attachment, which is only furnished on special orders, but will be found to have many uses. The common trouble of the gravel road is the wearing of deep ruts in it when it is soft, the material squeezed out from which gets almost as hard as concrete in dry weather. The ordinary drag or maintainer cannot cut this kind of road. In nearly every case the Austin Pup with the five-foot blade will do the job, but when it is too hard even for that, the scarifier can be brought into play, which will so loosen up the hard surface as to make it easy for the blade and the roller to do the rest. Frequently when hard gravel roads are to be redressed, it is much better first to scarify the surface, which makes a better bond between the old road and the new material, and when rolled with the Pup gives a finished job attainable in no other way.



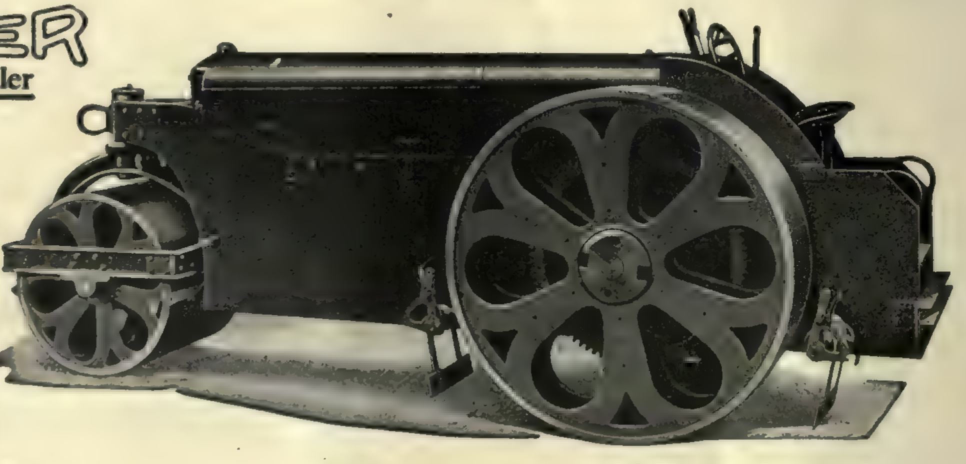
HIGHWAY CONTRACT NEWS

ALABAMA

Bids will be received by the State Highway Commission of Alabama at the office of the State Highway Department, Montgomery, Alabama, until June 16th, 1923, for the construction of 32.118 miles of road in St. Clair County, the same being a part of the road between Birmingham and Gadsden. The principal items of work are approximately as follows: Section "A", length 16.286 miles. 32.33 acres clearing and grubbing, 92,126 cu. yd. common excavation, 28,516 cu. yd. solid rock excavation, 70,675 sta. yd. overhaul on excavation, 1,460 lin. ft. 15 in. pipe, 1,192.5 lin. ft. 18 in. pipe, 156.4 cu. yd. Class "B" concrete in headwalls, 1,003.72 cu. yd. Class "A" concrete in culverts, 100,389 pounds reinforcing steel in culverts, 21,075 sq. yd. Bermuda grass planting, 24,588 lin. ft. ¾ in. guard rail cable, 42,500 cu. yd. chert surfacing within 1 mile, 60,000 ½ mi. units overhaul on surfacing. Section "B," length 15.717 miles. 43.58 acres clearing and grubbing, 101,322 cu. yd. common excavation, 22,233 cu. yd. solid rock excavation, 67,867 sta. yd. overhaul on excavation, 1,392.5 lin. ft. 15 in. pipe, 927.5 lin. ft. 18 in. pipe, 114.69 cu. yd. Class "B" concrete headwalls, 90,172 pounds reinforcing steel in culverts, 16,564 sq. yd. Bermuda grass planting, 20,648 lin. ft. ¾ in. guard rail cable, 40,950 cu. yd. chert surfacing within 1 mile haul, 115,500 ½ mi. units overhaul on surfacing. Section "C" five concrete bridges. 1,265.81 cu. yd. Class "A" concrete, 67.86 cu. yd. Class "B" concrete, 202,274 pounds reinforcing steel, 543 cu. yd. dry excavation, The pipe culverts on this project may be either double strength terra cotta, corrugated metal or reinforced. concrete. Plans and specifications are on file in the offices of the State Highway Department at Montgomery and in the office of the Division Engineer at Birmingham, Ala.

Bids will be received by the State Highway Commission of Alabama in the offices of the State Highway Department, Montgomery, Alabama, until June 19th, 1923, for the construction of a road in Marengo County between Demopolis and Millers. The length of road to be constructed is 23.655 miles and the principal items of work are approximately as follows: 42 acres clearing and grubbing, 140,734 cu. yd. common excavation, 626 sta. yd. overhaul on excavation, 485 lin. ft. 18 in. pipe new lines, 397.5 lin. ft. 18 in. pipe to be relaid, 382.5 lin. ft. 24 in. pipe to be relaid, 196.25 cu. yd. Class "B" concrete in headwalls, 730.41 cu. yd. Class "A" concrete in culverts, 71,358 pounds reinforcing steel in culverts, 56,000 cu. yd. imported gravel surfacing, 40,000 sq yd. Bermuda grass planting. Bridges. Alternate No. 1, using treated timber. 287,634 F. B. M. treated timber, 12,984 lin. ft. treated timber piles, 1 102.5 ft. steel span complete in place with floor, 200 cu. yd. Class "A" concrete, 104 cu. yd. Class "B" concrete, 4,600 pounds reinforcing steel, 1,280 lin. ft. untreated timber foundation piles, 2,791 sq. yd. 1½ in. cold mix bituminous surfacing. Alternate No. 2, using concrete. 2,045.29 cu. yd. Class "A" concrete, 321,051 pounds reinforcing steel, 7,763 lin. ft. concrete piles, 1 102.5 ft. steel span complete in place with floor, 200 cu. yd. Class "A" concrete in piers. 104 cu. yd. Class "B" concrete in piers, 4,600 pounds reinforcing steel in piers, 1,280 lin. ft. untreated timber, foundation piles, 565 cu. yd. dry excavation, 565 cu. yd. wet excavation, 2,231 sq. yd. 1 in. concrete surfacing, 1:2:3½ mix, 44 sets steel expansion plates.

Bids will be received by the State Highway Commission of Alabama at the office of the State Highway Department, Montgomery, Alabama, until June 19th, 1923, for the construction of a road 6.19 miles long in Clarke County, the same being a part of the road between Selma and Mobile. The principal items of work are approximately as follows: 13.98 acres clearing and grubbing, 38,766 cu. yd. common excavation, 100 cu. yd. solid rock excavation, 3833 sta. yd. overhaul on excavation, 17,200 cu. yd. gravel surfacing within 1 mile haul, 50,000 half mi. units additional haul on gravel, 242.5 lin. ft. 15 in. pipe, 40.71



THE HUBER Motor Roller

Steam or Motor Rollers

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GOOD ROADS

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The Journal of Highway Engineering and Transportation

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Vol. LXIV JUNE 13, 1923 No. 24

Funds Approved for Roads in California Forest

Expenditures totaling $646,000 of national forest highway funds for 6 road-building projects in California have just been approved by Secretary of Agriculture Wallace. This money was made available for roads serving the national forests and for roads within or adjacent to the national forests which are of primary importance to states, counties, and communities.

The expenditures include $75,000 for the Crescent City-Grants Pass road in Del Norte County between the Oregon State Line and Tunnel Site. This money is additional to funds already appropriated and is to be spent in lengthening the original project 2 miles. This road is within the Siskiyou National Forest.

In Kern County between First Crossing of Kern River and Democrat Springs a little more than 8 miles of road is to be built, for which purpose $150,000 has been authorized. This road lies within the Sequoia National Forest and will open up a large recreational area, as the Kern River Canyon offers a large number of excellent camp sites.

An additional $75,000 has been approved for extending the Big Bear Valley road in San Bernardino County 3 miles east of the dam, thus making the total length of this project a little over 13 miles, all of which is within the Angeles National Forest.

Expenditures amounting to $160,000 have been authorized for over 15 miles of road in Mariposa County between Murphy and Bigtrees in the Stanislaus National Forest, and $143,000 has been authorized for 13 miles of the Yuba Pass highway in Sierra County between Gold Lake Road Junction and Sattley in the Sierra National Forest.

In addition to the funds approved for highway construction work $43,000 has ben allotted for location surveys involving 75 miles of highway in different sections of California.

Indiana to Open Bids for 25 Miles of Roads on June 23

Bids will be received by the State Highway Commission on June 26 for improving approximately 25 miles of secondary roads, the proposals asking for prices for grading and structures under 20 feet. The mileage is divided into five projects as follows:

St. Meinrad-Leavenworth road, St. Meinrad to the Bristow-Birdseye road, in Spencer and Perry counties, 8.269 miles.

St. Meinrad-Leavenworth road from Sulphur to Leavenworth, in Crawford county, 7.292 miles.

Shoals-Mitchell road, 2 miles east of Shoals to Willow Valley, in Martin County, 1.220 miles.

Angola-Michigan State line road, 3 miles north of Angola to the Michigan state line, in Steuben county, 4.552 miles.

Scottsburg-Blocher road, 3 miles east of Scottsburg to Blocher, in Scott County, 5.002 miles.

The St. Meinrad-Leavenworth road projects are on State Road 16 and open a cross-country route connecting from Gentryville through Corydon to New Albany. They connect with the road passing the Nancy Hanks Memorial at Lincoln City and lead through one of the most primitive and picturesque parts of extreme southern Indiana.

Good Progress on Roads Seen as 1923 Season Opens

The 1923 road-construction season opens with the prospect that there will be about the same amount of road construction as last year, which was a very satisfactory one, according to the U. S. Bureau of Public Roads.

Returns from 21 scattered States show that in these States there will be available $288,000,000 for road work, as compared with $273,000,000 spent in the same States last year. On Federal-aid work, which constitutes something like half of the total construction, there was under construction on March 31 work estimated to cost $258,000,000, as compared with $233,000,000 12 months previous.

Wages of labor are generally slightly higher than a year ago, with the exception of the Pacific coast, where the same rate prevails. The greatest increase is in New England, where the present level is approximately 30 per cent. higher than the level of a year ago.

The general outlook is considerably better than one year ago, when the railroad and coal strike loomed as disturbing factors. Added to this is the fact that the designation of the system of Federal-aid highways is now completed in 33 States and practically complete in most of the others. With a definite program for accomplishment laid out road work can proceed much more smoothly.

From the latest reports it appears that 30 States now tax gasoline as compared with 4 States at the beginning of 1921. Most of the revenue derived goes for road purposes, and bureau officials regard this as a step in the right direction. With road users playing a more equitable share of the cost, highway finance is placed upon a firmer foundation.

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Minnesota Cuts Outlay for Good Roads Despite Continued Increase in Traffic

Fund Increase Is Less than Four-fold and Travel on Highways Is Fourteen Times Heavier than Ten Years Ago—Less Money for Main Routes, More Provided for Local Roads

Public roads in Minnesota are being used nearly fifteen times more than 10 years ago, but road funds are less than four times greater, according to a showing made on official figures i na bulletin just issued by the state highway department.

The roads now are carrying 100 vehicles for every 7 vehicles using them a decade ago. But for every $100 provided for roads this year there was $25 ten years ago. Another outstanding feature of the showing is that three times as much will be spent on local roads this year as on the trunk highways which carry four-fifths of the traffic. Trunk funds are the smallest for five years, in spite of the steady gain in traffic, and only about half those available last year. Here is the bulletin table based on official records from which the comparisons are drawn.

Year	Main Roads	Local Roads	All Roads	Motor Vehicles
1923	$ .25	$ .75	$1.00	100
1922	.49	.61	1.10	90
1921	.61	.67	1.28	78
1920	.43	.72	1.15	67
1919	.37	.42	.79	57
1918	.18	.23	.41	47
1917	.16	.21	.37	34
1916	.12	.18	.30	21
1915	.11	.16	.27	10
1914	.10	.15	.25	7

Local road funds this year—those handled by county, township and city-village road officials—are the largest of record, and five times those of ten years ago, it is noted. For every dollar spent on main roads ten years ago there was $1.50 for local roads, while now there is $3. The detailed figures afford many other comparisons.

Steady and rapid increase in the use of motor vehicles as a factor in highway improvement in Minnesota is apparent on the annual figures. Although the increase in funds for road purposes has not kept up with that in the number of automobiles and other vehicles using the roads, it has continued every year and has been most marked in the last five years. The big jump in funds was in 1919 and the high mark was reached in 1921, the bulletin points out. Charles M. Babcock, state highway commissioner, in 1919 offered the good roads plan proposing that motor vehicles pay more toward highway improvement and the legislature authorized counties to issue large amounts of road bonds. Many counties promptly exercised this authority and many continued the regular road and bridge tax levies without allowing for decreased demands on local funds following the transfer to the state of the more expensive main highways. The result was the general increase in funds.

Automobile owners readily foresaw that better roads would mean less expense for repairs, pull-outs and other times, besides more comfort and greater convenience for all highway users, the bulletin continues. Then followed the growing demand for more adequate roads. Progressive farmers, realizing how they would benefit most by the improvement of the roads and how the financing of main highways with motor vehicle tax revenue would release general tax funds for local roads, supported the movement.

That farmers favor and are willing to pay for road improvements is held evidenced by their votes increasing township road funds this year, while county and city-village levies are reduced. Farmers have closer control of township road tax levies than any others. Confined to a statement of facts and figures, the bulletin makes no comment on the big reduction this year in funds available for use on the big 7,000-mile system of main or trunk highways.

It does state that this year there is $1 for trunks against $3 for local roads and that the trunks are used by four out of five vehicles on the highways. This echoes the reason why the state can make no improvements on the trunk routes this year and is obliged to expend remaining funds for the maintenance of the inadequately improved routes under the grind of heavier traffic.

State highway officials have repeated, however, that the program can be financed entirely with motor vehicle tax revenue at the agreed $18 average and reasonable federal aid apportionments. Also, they assert that the method of using the trunk highway income will largely govern the progress of improvement of the big system, especially during the next ten years.

Oregon's New Commission to Continue Highway Program

Because of a change in state administration the resignations of all the members of the former State Highway Commission have been accepted by Governor Pierce. With the recent appointment of Wade H. Malone, formerly County Judge of Benton County, to succeed R. A. Booth, the retiring chairman of the old commission, an entirely new body of men has been put in charge of Oregon's highway construction. The three new members appointed this year are:

William Duby, of Baker, Chairman.

H. B. Van Duzer, of Portland.

Wade H. Malone, of Corvallis.

In view of Governor Pierce's professed policy of retrenchment and lowering of taxes, Oregon good roads boosters have been somewhat doubtful as to the attitude of the new commission. However, at a recent conference with Federal road authorities, Commissioners Van Duzer and Malone took the stand that all contracts entered into by the old commission should be carried out and all agreements with county courts fulfilled.

Oregon has met all Federal appropriations and the 1924 apportionment is now allotted to projects practically all of which are under construction. In fact, the state stands ready to meet the 1925 apportionment of Federal aid as soon as permitted by Federal authorities, and it is a "grand and glorious feeling" to know that this proud record will not be dimmed by the new commission.

Standardization of Concrete Mixers is Proposed

A cooperative movement on the part of equipment manufacturers and contractors, assisted by mechanical engineers, resulted in the formation, last fall, of what is called the Joint Conference of Equipment Manufacturers and the Associated General Contractors of America. This conference decided to investigate the possibility of standardizing various lines of equipment, and for the purpose of initiating discussion with the various groups of manufacturers, appointed a standardization steering committee, of which R. C. Marshall, Jr., Washington, D. C., is chairman.

The steering committee, consisting of contractors and engineers, met with a number of concrete mixer manufacturers in that line of production.

It was recommended that the entire standardization procedure be tied in officially with the American Engineering Standards Committee, which is the best means, probably, of producing American standards, and that all mixer manufacturers be invited to attend a meeting for the purpose of making recommendations and, if possible, starting the work. This meeting will, in all probability, be held in Chicago within the next month.

New Good Roads Association Formed in Georgia

More than 100 delegates braved almost impassable mountain roads to get to the organization meeting of the Nacoochee-Hiafassee Scenic Highway Association meeting here on June 2. Instead of being discouraged at the prospect, those attending the conference were more determined than ever to get good roads in their section, and the formation of the new association went forward with neatness and despatch.

C. W. White, of Helen, Ga., was elected president of the new highway association. O. L. Anderson, of Hayesville, N. C., was elected vice-president. B. H. Stone, of Hiawassee, Ga., was elected secretary, and G. H. Haigler, of Hayesville, N. C., treasurer. A constitution and by-laws was drawn up and adopted in addition, and all necessary steps taken to make it a permanent organization.

The new association will work for the building of a complete system of good roads in north Georgia and that portion of North Carolina lying directly north of Georgia. It plans to improve the roads now in existence, and to build the necessary new roads to complete a scenic highway system. It will also perpetuate the Indian legends of the section in naming the roads, and will advertise the different highways when they are completed and thrown open to the public.

The section of State highway from the foot of La Bajada Hill to Algodones, New Mexico, will be paved in the near future, according to State Highway Engineer L. A. Gillett. The road, 24 miles long, will be paid for entirely by the government, owing to the fact that it is located entirely across an Indian reservation.

Lincoln Highway In Good Shape

Association Issues First Touring Report for 1923

This following report, the first of the 1923 touring season, gives a complete picture of the present condition of the Lincoln Highway. The data is provided by wire by the Consuls of the Association from along the route between the two coasts and is authentic. These reports will be published twice monthly until November 15th for the convenience of the traveling public using the Lincoln Highway.

Division 1.—New York City to Philadelphia, Pa.—96 mi. Weehawken Ferry to Princeton—52 mi.—excellent, except for 2 mile detour around Metuchen and somewhat rough through New Brunswick; Princeton to Lawrenceville—5 mi.—poor macadam; Lawrenceville to Trenton—6 mi.—excellent; Trenton to Philadelphia—32 mi.—excellent.

Division 2—Philadelphia, Pa., to Chambersburg, Pa.—142 mi. Entire section in good to excellent condition; no detours. New construction going on between Gettysburg and New Oxford and west of Malvern being accomplished one-half at a time and will not seriously impede traffic. Oiling schedule also being conducted on one-half of road at a time, freshly oiled road marked, do not drive on oiled section.

Division 3—Chambersburg, Pa., to Greensburg, Pa.—122 mi. Perfect road, all well-maintained macadam and new concrete; no detours.

Division 4—Greensburg, Pa., to East Liverpool, O.—82 mi. Greensburg to Pittsburgh—30 mi.—excellent; Pittsburgh to East Liverpool, O.—52 mi.—caution; inquire of Pittsburgh Automobile Club, 413 Wood street, as to most advisable route west, i. e., via Beaver north of the Ohio River or via Clinton, south of the river; dirt sections of both routes reported to be in bad shape, may be necessary to go via Beaver Falls, East Palatine, Salem and Alliance to Canton. Latter route much longer but paved.

Division 5—East Liverpool, O., to Mansfield, O.—118 mi. East Liverpool to Lisbon — 17 mi. — detour around new construction marked (8 mi.) dirt road and hilly but fair in dry weather. Going east the detour is to the right at the bridge just as you are leaving Lisbon (one-way traffic). Going west leave the Lincoln Highway near the big concrete bridge 5 mi. east of Lisbon. Lisbon to Canton—36 mi.—all good. Canton to Ashland—51 mi.—excellent; Ashland to Mansfield—14 mi.—paved, except one-half mile dirt fair condition.

Division 6—Mansfield, O., to Van Wert, O.—111 mi. Detour Mansfield to Bucyrus via Shelby and Crestline after construction starts on Galion detour; Bucyrus to Osceola—7 mi.—excellent; Osceola to Van Wert—79 mi.—passable but rough in places (old macadam).

Division 7—Van Wert, O., to South Bend, Indiana—116 mi. Van Wert to Fort Wayne, Ind.—35 mi.—good to State line, detour between State line and Fort Wayne, construction under way, detour marked; Fort Wayne to Ligonier—38 mi.—detour between Fort Wayne and Churubusco, construction under way, detour marked; Churubusco to Ligonier excellent. Ligonier to South Bend—43 mi.—excellent.

Division 8—South Bend, Ind., to Chicago Heights, Ill.—83 mi. South Bend to New Carlisle—14 mi.—excellent; New Carlisle to LaPorte—13 mi.—very rough old macadam; Laporte to Valparaiso—23 mi.—excellent; at Valparaiso detour over good, well-marked road via Hobart to Merrillville (construction under way)—20 mi. Merrillville to Chicago Heights—17 mi.—concrete.

Division 9—Chicago Heights, Illinois, to Clinton, Iowa—166 mi. All excellent concrete paving with exception of stretch between Plainfield and Aurora (13 miles), fair detour marked, construction under way.

Division 10—Clinton, Iowa, to Marshalltown, Iowa—164 mi. Clinton to Dewitt—20 mi.—concrete paving; DeWitt to Cedar Rapids—67 mi.—fair to good, two short detours bad in wet weather, marked; Cedar Rapids to Marshalltown—75 mi.—all excellent including marked detour between Chelsea and Tama—12 mi.

Division 11—Marshalltown, Iowa, to Dennison, Iowa—142 mi. Dirt roads in excellent condition; short detour at Scranton. About 85 miles of gravel road in this division, balance affected by wet weather.

Division 12—Dennison, Iowa, to Council Bluffs, Iowa—76 mi. All dirt road, but well graded and dragged and in excellent condition, except for a few hours after each rain. No detours.

Division 13—Omaha, Nebr., to Kearney, Nebr.—204 mi. Paved Omaha to Fremont—39 miles; Fremont to Kearney some concrete, some gravel, some dirt affected by weather conditions, good when dry.

Division 14—Kearney, Nebr., to Sidney, Nebr.—226 mi. Kearney to Gothenburg—66 mi.—excellent dirt and gravel, no detours; Gothenburg to Brady—13 mi.—good with the exception of crossing irrigation canal (temporary structure); detour south over well-marked road from Brady to North Platte—23 mi.—good dirt; North Platte to Sidney—124 mi.

Division 15—Sidney, Nebr., to Laramie, Wyo.—157 mi. Road in first-class condition entire distance, short section of construction going on between Cheyenne and Laramie, no detour required.

Division 16—Laramie, Wyo., to Rock Springs, Wyo.—238 mi. Laramie to Medicine Bow—60 miles, excellent; Medicine Bow to Rawlins excellent except short rough stretch near Walcott; Rawlins to Rock Springs—114 mi.—fair to excellent except rough stretch between Thayer Junction and Point of Rocks—7 miles.

Division 17—Rock Springs, Wyo., to Echo, Utah—150 mi. Rock Springs to Green River—15 mi.—excellent; fair to good to Lyman—62 miles; Lyman to Evanston—41 mi.—likely to be muddy and bad but cars going through; Evanston to Wasatch, Utah—10 mi.—excellent; Wasatch to Echo poor but passable—25 miles.

Division 18—Echo, Utah, to Gold Hill, Utah—195 mi. Echo to Salt Lake City—50 mi.—excellent; Salt Lake City to Tooele—40 mi.—excellent; Tooele to Bush's Ranch—19 mi. excellent; Fisher Pass between Bush's Ranch and Orr's Ranch (17 miles) in fair shape; inquire of J. H. Waters, Newhouse Hotel, Salt Lake City, regarding conditions on Desert; Goodyear Cutoff passable but rough (impassable in wet weather); Black Point to Gold Hill—12 mi.—fair; weather very materially affects conditions now.

Division 19—Gold Hill, Utah, to Eureka, Nevada—194 mi. Gold Hill to Ibapah—13 mi.—fair with some rough stretches; Ibapah, Utah, to Ely, Nevada—95 mi.—fair to good, Schellbourne Pass open; Ely to Eureka—87 mi.—fair with several rough stretches on the flats.

Division 20—Eureka, Nevada, to Fallon, Nevada—191 mi. Eureka to Austin—73 mi.—good condition; Austin to Fallon—118 mi.—reported excellent, New Pass Canyon fair, Flats hard and travelable.

Division 21—Fallon, Nev., to Placerville, Cal., direct, via Carson City—152.8 miles. Fallon to Leetesville Fork—8 mi.—excellent; Leetesville via Lahontan Dam to Dayton—45 mi.—fair to good extensive improvement under way, no detours; Dayton to Carson City—13 mi.—good; Carson City to Placerville, California, via Lake Tahoe and the Ostermann grade—86 mi.—now open and being traveled.

Division 22—Placerville, Cal., to Oakland and San Francisco—177 mi. All paved.

Division 23—Fallon, Nev., via Reno to Sacramento, Cal.—213 mi. Fallon to Reno—67 mi.—fair to good, short detours on account of new construction; Reno via Dog Valley grade and Donner Summit to Auburn—110 mi.—will open for travel about June 1st, but rough in places; Auburn to Sacramento—36 mi. paved.

Foundation for Road Pavements

Flexible foundations, says Mr. H. W. Skidmore, English highway authority, include gravel, broken stone, water-bound macadam, bituminous macadam, and hot-mix bituminous concrete. They are usually classified as to value in a pavement structure in reverse of the order named, with bituminous concrete as the highest type. It is estimated that there are 15,000,000 square yards of "black base" giving satisfactory service in England. The bituminous foundation structure, although possessing considerable beam strength, functions primarily as a shock reducer, that is, it gives slightly under the blow of impact in transmitting the load to the subgrade. Its use, then, is dependent upon a knowledge of the ability of the subgrade to support loads equal to the probable force of impact reduced by the slab strength residing in the bituminous structure; whereas, the rigid type, regardless of the bearing power of the soil, must be built to sustain the entire force of impact. For this reason a much thicker rigid foundation is required under given traffic and subgrade conditions, as has been demonstrated by impact tests.

Vero, Florida, inspired by the success of their city beautification campaign, the members of the Fort Pierce Chamber of Commerce propose the formation of a county wide beautification, with the object of beautifying the main highways throughout the county by planting trees and shrubs. The movement is one that deserves the support of all the people of St. Lucie County. And if every section of the county will get behind it there is no question as to its success, because St. Lucie County usually accomplishes whatever it sets out to do.

"Roads to Wonderland" New Film on Forest Road Making

How the Federal Government, through the agency of the Bureau of Public Roads, is breaking down the barriers which conceal many of nature's scenic treasures is shown in the latest United States Department of Agriculture film release, "Roads to Wonderland."

The new film shows how, through the enterprise and daring of the highway engineers, walls of rock and timber are penetrated to construct avenues of entrance to majestic Mount Hood in the Oregon National Forest, the incomparable beauties of Crater Lake National Forest, the wonders of indescribable Yosemite with its Bridal Veil Falls, El Capitan, Mirror Lake, Merced River, and Inspiration Point, the near-by Hetch Hetchy Valley, and other matchless gems of nature's handiwork. The film was produced by the United States Department of Agriculture, the Bureau of Public Roads, and the Forest Service cooperating with the National Park Service of the Department of the Interior.

"Roads to Wonderland" will be circulated through the department's film distribution system. Prints may be bought by agricultural colleges, schools, and other authorized purchasers at the laboratory cost.

At a meeting of the State Highway Commission, Federal Aid totaling nearly $900,000 was appropriated to various counties for road and bridge construction.

If all present plans carry, within the next year, Charlotte, Florida, will be very fortunately situated as to improved roads. Within that time State Road No. 5 will have been completed across the county on to Fort Meyers, and with the sanction of the legislature De Soto County will issue time warrants to obtain funds to rebuild De Soto County part of what is locally called the Punta Gorda-Arcadia road which has been in very poor condition for the past several years. Likewise the commissioners of Hardee County will ask the legislature for authority to issue time warrants to secure funds to rebuild State Road No. 2, from Carlston Field south to the Charlotte County line.

GOOD ROADS

Title Reg. U. S. Pat. Off.

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Wendover Cut-Off in Victory Highway Approved as Federal Aid Project

Motor travel into northern and central California will be greatly expedited by the building of the Wendover Cut-Off link in the Victory Highway which has just been approved as a Federal aid project by Secretary of Agriculture Henry C. Wallace. Salt Lake and Ogden are considered gateways to the West, the tourist going north from these points to reach the Pacific Northwest; south to reach southern California and west to reach northern and central California.

According to advices from the California State Automobile Association the two roads leading from Salt Lake City into northern and central California were in bad shape and the State of Utah recently decided to submit as part of its recommended Federal aid system a road extending from Salt Lake City, westward to Wendover and the Nevada State line there to meet a similarly designated road on the Nevada highway system. This recommendation was submitted to Secretary Wallace and the Secretary, after some consideration approved the project. After a preamble, setting forth the merits of the case the Secretary, in a written opinion, says:

"It appears that the State of Utah is ready with funds to proceed with a project at once which will build the most urgent section across the Great Salt Lake Desert on the Wendover route, a portion of this fund being an appropriation by the last State Legislature of the State of Utah for this specific purpose. This, with the program for additional construction and future maintenance, will insure the completion of a road from Salt Lake City to the Nevada State line at any early date. The disapproval of this project would leave the completion of such a road indefinitely suspended, whereas its completion is deemed a public necessity, and will not prohibit a reasonable adjustment of the conflicting interests involved.

"The system of highways as submitted for the approval of the Secretary as the Federal Highway system of Utah is therefore approved."

Northern and central California are greatly interested in the building of this new link in the Victory Highway and have joined with the California State Automobile Association in raising $50,000 to be applied to this work for the purpose of bringing additional tourists into California. Records for transcontinental touring will be broken this year, according to indications at the Washington and New York Touring Bureaus of the A. A. A. This prediction is based on the number of maps and the touring information sought by A. A. A. members contemplating the trip. Completion of the Wendover Cut-Off will give the tourist his choice of three sections of the Golden West in which to spend his vacation.

Cement Production Reaches New High Record During May

With a production of nearly 13,000,000 barrels of cement in May the cement industry of the country established a new high record for any single month. May production was more than 1,500,000 barrels greater than in April and 1,700,000 barrels or 15 per cent. greater than in May, 1922. For the first five months of the current year production very closely approached the 50,000,000 barrel mark—14,000,000 barrels more than in any similar period.

Shipments from the mills during May were also heavy and reached a total of 14,257,000 barrels or 12 per cent. more than in May, 1922. For the five months' period ending May 31, shipments were approximately 48,900,000 as compared with about 34,600,000 during the first five months of 1922, the best previous record.

Stocks of cement in manufacturers' hands at the end of May were 10,115,000 barrels as compared with an average on that date of 11,725,000 barrels for the five year period—1919-1923.

Unusual activity in the construction field, early storing of cement and of late, the commendable record the transportation systems are making in handling traffic are responsible for the record breaking shipments of cement thus far experienced. With the very large programs of building and concrete pavement construction now in full swing, the year promises to be an active one in the cement industry.

Although stocks of cement have been decreasing since the first of March, May production was at the annual rate of approximately 155,000,000 barrels which is considerably in excess of the amount consumed in any one year. Production will undoubtedly be still further increased by the recent placing in operation of two new mills and completion in the near future of extensions to several existing plants.

H. G. Shirley, chairman of the State Highway Commission of Virginia, has announced that the Legislature has placed a 3 cent tax on gasoline, 2 cents of which will go to state highways and one to feeder roads. The Legislature also passed a bill allowing the Governor to anticipate $1,700,000 under the mill tax appropriation, shown in his report as not being available until December.

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Kentucky to Pave Dixie Highway Throughout State

A paved Dixie Highway from Cincinnati straight through to Lexington is the goal set by the people of northern Kentucky, says E. O. Mills, Road Engineer, Kenton County, Ky., in a recent issue of "Concrete Highway Magazine." Kenton County first adopted the policy of really investing— not merely spending—road improvement funds by paving 5.6 miles with concrete in 1915 and 1916. More recently this county showed its continued interest by giving $30,000 to the state toward the cost of five miles more which will finish the paving within the county boundaries. Other counties built more concrete at two points on the Dixie Highway, which is now a state route.

In the days following the close of the Civil War, Cincinnati saw an opportunity to secure the trade of the rich Bluegrass country of Kentucky and wholeheartedly went after it by building the Lexington Pike, now part of the Dixie Highway, largely by popular subscription. Later the road was macadamized and operated as a toll road until the various sections were bought by the counties. Under the motor vehicle traffic of recent years, the cost of maintaining the macadam surface became excessive; even prior to 1915, maintenance expenditures each year amounted to as much as $2,000 a mile in Kenton County. Now a good start has been made toward paving the entire Covington-Lexington link of 86 miles, which means that eventually maintenance of the road will become a very small matter.

Williamstown is one of the points where concreting was carried on during 1921. One and one-half miles of street pavement varying in width from 24 to 37 feet and three miles of 18-foot slab were included in the job, which was awarded to Cornell and Bracht of Williamstown. Grant County donated $20,000 toward the construction of the three-mile section. State funds brought the amount available to half the total cost and Federal Aid paid the remainder. Through Williamstown the abutting property owners are paying everything in excess of half the cost of a 20-foot strip, that amount being taken from Federal Aid funds. Combined curb and gutter 24 inches wide was built on both sides of the street pavement.

Coming north from Williamstown the next concrete encountered is at Walton in Boone County. Through this town there is a mile of pavement of which part is only 18 feet wide and the remainder considerably wider. This pavement which was built in 1918-19 was paid for jointly by the state and town. Paving the main street has made a remarkable improvement in Walton and the residents are proud of their "city pavement."

From Florence in Boone County to Erlanger in Kenton County, there is still another section of concrete. Two and two-tenths miles were finished there in 1920. This stretch is made up of a 20-foot pavement in Florence, an 18-foot slab between the two towns, and in Erlanger a pavement 33 1-3 feet wide between the edges of the combined curb and gutter. In the latter town about three-fourths of a mile of 30-foot slab connects the earlier Kenton County pavement with the section described above. M. D. Ross, Division Engineer for the State Highway Commission, was in charge of this work, and of all the other paving on the Dixie Highway as well.

Only six years ago Erlanger placed a macadam surface on the street concreted this season, paying for it with ten-year serial bonds. With only half the payments made the townspeople found it necessary to replace the macadam and this time insured themselves against disappointment by choosing concrete. The state is paying for half of an 18-foot road and the property owners meet the remainder of the cost under the assessment warrant plan.

When the first section of concrete was placed on this route in 1915 just out of Covington, which is across the Ohio River from Cincinnati, the road was used by about 2000 vehicles daily. Since then the traffic has at least doubled. In addition to the large volume of through traffic and the farm hauling, a great many delivery trucks go over the concrete near Covington en route to the suburb of Fort Mitchell and the many homes being built a short distance beyond. Since no railroad reaches the community, building materials, coal, groceries and supplies of all kinds must be hauled in by road.

Considering the saving in maintenance under increased traffic and the lower cost of operating a motor car on concrete, there is no doubt that the original 5.6-mile stretch of pavement in Kenton County has more than paid for itself since it was built in 1915-16.

State Highways to be Named in Pennsylvania

That an intensive campaign be inaugurated to make each state highway in the Keystone state known by name for the entire length of the route is one of the recommendations in a report to Governor Gifford Pinchot by the Citizens' Committee on Finances appointed by the Governor to recommend a fiscal policy for the new state highway department. The committee recommends also that separate names, instead of numbers be adopted for highway sections between centers of population symbolic of the communities through which the highways pass. A more extensive application of information and direction signs and traffic control markers to the state roads is also recommended.

In reference to engineering and construction policy the committee recommends that the department "discontinue the policy of calling for bids exclusively on cement concrete pavement to such an extent as has been the practice where other comparable standard high class types would fit the situation equally as well."

"In cases where detours will result in great hardship to the traveling public," says the report, "the pavements should be constructed for half the width at a time where practicable, and the traffic allowed to use the other half of the roadway.

"A more rigid policy should be adopted with respect to oiling only half sections of a road at a time. This work should be done in such a manner that one side of the road will always be sufficiently dry so that it will not damage the paint on vehicles traveling at a normal rate of speed.

"Nothing has been done to allay the dust on the several thousand miles of earth roads. The more important of these roads should be oiled."

The report was drafted for the Citizens' Committee by William H. Connell, formerly chief of the Philadelphia Bureau of Highways, who has been appointed chief deputy state highway commissioner by Governor Pinchot and the recommendations hade have been approved and adopted by the administration.

Iowa Has 5000 Miles of Improved Roads

Iowa now has 5027 miles of improved road not including that added during the last season, according to the bureau of public road, United States Department of Agriculture, which has made a complete census in the state. The improved road mileage at the beginning of 1922 was as follows:

Gravel and drained	2422
Gravel and shale	2346
Surface treated macadam	1
Cement concrete	187
Brick	51

The total road mileage of the state is 104.082 miles, as compared with 104,074 miles in 1914, and during the seven year period from 1914 the surfaced and paved roads have increased from 615 to 2585 miles.

The total road revenue in 1921 amounted to $37,991.782 or $683 for each square mile of area, $365 for each mile of road, or $15.80 per capita.

Editors and their friends attending the mid-summer meeting of the Democratic State Editorial Association at Vincennes June 8 and 9, were invited by the State Highway Commission to drive 18 miles south on State Road 10 and look at the big bridge which the highway department is building across White river at Hazleton. The Hazleton bridge with approaches is 2000 feet long and will cost approximately $285,000. It will be opened to traffic early in October, Mr. Williams says. Highway officials point out that the bridge crossing is on No. 10, one of the principal state roads and a highway used by many motorists coming into Indiana from southern States. There has never been a bridge at this point, the river crossing being made by ferry which, in periods of flood waters, was impossible to use resulting in traffic being blocked.

O. B. Kercher, whose home city is Goshen, Ind., has succeeded W. T. Horn, resigned, as engineer of the Fort Wayne district for the State Highway Commission, John D. Williams, director, announces.

Mr. Kercher comes back to Indiana from Fort Worth, Texas, where he was employed in the Federal road department. Prior to going west a few years ago he was connected with the Indian highway department. In his capacity as district engineer he will have charge of state roads in the counties of Allen, Lagrange, Elkhart, Kosciusko, Miami, Steuben, Dekalb, Adams, Wells, Huntington, Wabash, Whitley, Noble, and parts of Grant, Marshall and St. Joseph. In all he will have 700 miles under his jurisdiction.

C. Gray, chief engineer of the Indiana State Highway Commission, has been notified that the faculty of Rose Polytechnic Institute, Terre Haute, of which he is a graduate, has recommended to the Board of Managers that a civil engineering degree be conferred upon him. The honor will be conferred at graduation exercises this month.

Mr. Gray has been chief engineer of the Indiana highway department since 1920 and prior to that was road engineer under H. K. Bishop, then chief engineer. He served nine months overseas constructing permanent air service camps in England. Before his public and army service he was for five years an engineer in the employment of the Pennsylvania railroad.

Indiana Has Big Bridge Program

Over 10,000 Bridges Must Be Replaced, Says Highway Commissioner

Confronted with the stupendous task of ultimately building 10,000 bridges and culverts in the present state highway system of 4,500 miles, and present facilities permitting construction of only 100 to 150 miles, structures annually but which will increase and care for an augmented number each year, John D. Williams, director of the state highway system, urges the public to have patience and refrain from passing hasty judgment on why these crossings are not immediately replaced.

Many of these structures—possibly 5,000—are one way crossings that is so narrow they permit only one way traffic. Others designed in a period when a team, wagon and possibly two or three ton loads were considered the maximum of road haulage, will not sustain heavy and congested traffic of this time. Such bridges are marked and traffic is urged to drive carefully with the fact in mind they are dangerous if two machines meet on the bridge; also load capacity frequently is only two or three tons. Proper cooperation on the part of the public will go far to reduce preventable accidents and frequent fatalities due to such a condition, Mr. Williams says.

William J. Titus, chief bridge engineer under whose direction the Indiana highway commission bridge program is advancing, cites attention that these inadequate bridges are on roads taken into the system. Many are old and the greater number were built when public roads were 9, 10 and 12 ft. wide, with bridges 14 ft. wide at maximum. Even some of the later designed bridges are too narrow. Few of the older bridges were designed, he says, to care for more than 5-ton traffic, whereas loads of today normally run from 8 to 15 tons and occasionally 20 tons.

"It is not only a physical but a financial impossibility to replace these bridges even in the next decade. Such a program necessarily must extend over a period of 15 or even 20 years," Mr. Williams says. "However, the highway commission is making every effort with facilities at its command to take care of the most hazardous crossings and culverts. With these facts in mind, the public particularly if inclined to think the commission should immediately repair or replace a certain bridge, should refrain from hasty judgment or criticism at what might appear unnecessary delay, Mr. Williams contends.

According to Engineer Titus it is necessary that bridges on federal aid roads be rebuilt first or otherwise these roads when paved would have numerous detours for lack of crossings. This is an impossible situation, he says.

"We are now in a position to construct with field forces 100 to 150 small bridges and culverts each year. As fast as possible we are increasing these facilities and we hope to extend our program to increase the number of bridges built and repaired each year," he says. "In the meantime the public must bear in mind that certain bridges and culverts are hazardous for speedy traffic or extreme heavy loads. If people will remember this and observe the warning signs posted on such structures, many accidents now due to narrow bridges and bridges of limited capacity will be avoided."

Standard plans used by the state highway commission call for the bridge floor to be 20 ft. wide, to withstand 20-ton traffic and officials estimate such a bridge will last from 40 to 75 years or even longer. Such a structure will handle present and probably future traffic during life of the bridge, they say.

Good Road Notes from Florida

By C. O. LANGSTON

The citizens of Duval County, Florida have voted the issuance of $3,000,000 in bonds to build roads. The County Commissioners will soon have the bonds on the market. Information can be had regarding surveys and other detail from Col. Coe, County Engineer.

Announcement is made in Waycross, Ga., that the Georgia State Highway Department has awarded contract for six and a half miles of semi gravel road from the city limits of Waycross to the iron bridge on the Waycross-Alma road to S. W. McWhorter, of Birmingham, Alabama. The contract involves an expense of $33,958.91. This road is part of one of the routes that run into the Dixie Highway traveled yearly by the thousands of tourists going to Florida.

Pinellas County voted six to one for issue of $2,863,000 road and bridge bonds for the purpose of rebuilding its entire system of county roads sixteen feet wide. Of this sum $2,567,000 is to be spent for roads, and $266,000 for bridges.

$650,000 will be spent in Deland for pavement sewerage and water works improvements. Passage of a bill by the Legislature made this possible for Deland. The bonds have been approved by John C. Thompson of New York.

Two years ago the people in the north end of Palm Beach County set about to put in a system of roads and bridges that would connect up all the various settlements of towns and villages. The last obstacle to complete the system has been overcome and everybody is rejoicing over the result. Last week the people of Salerno, Tropical Farms, and the commercial club of Stuart sent Commissioner Gaines to Tallahassee to get through some bills the accomplishment of which has given much satisfaction here, the roads are assured.

The Kinston-Greenville Highway, asphalted road traversing the richest section of Lenoir and Pitt Counties, will be completed save for a bridge over Moccasin River before midsummer, construction men predicted today. Road-builders are working on the stretch between Grifton and Henrahan. The route from the latter place to Ayden was completed a short time ago.

Authorized to engage in highway construction, the Gloucester Good Roads Association of Gloucester, Va., was recently granted a charter with maximum capital fixed at $100,000 and minimum at $1,000. The incorporators were listed as W. T. Ash, Gloucester, president; W. A. Robinson, Gloucester, secretary, and J. R. Newcomb, White Marsh.

A special committee or commission, to study highway beautification for Duval County, serving without pay, has been authorized by the board of county commissioners, in response to a request from the Civitan Club, and this is believed to be the first step toward developing a constructive county-wide program.

When the Civitan Club presented several recommendations to the county commissioners, they were referred to the road and bridge committee for consideration, this committee including the entire personnel of the board.

At the meeting last week, the recommendation of the committee was adopted by the board, approving of the creation of such a committee, and authorizing the clerk, Frank Brown, to request the Civitan Club to suggest the individuals to serve on this committee.

It is generally understood that the men appointed will include a representative from the Civitan, Rotary and Kiwanis clubs, with two women. One who has been suggested is a woman who is prominent in the Garden Club of Florida, and who has in her extensive travels made a study of park and boulevard beautification.

This committee, which will be a volunteer body serving without any compensation, will make a complete survey of the roads, and will make suggestions for a constructive program.

The 350 miles of asphalt roads, built throughout Polk County, Florida, with the several bond issues of a few years ago, have proved to be such a factor in the development of the agricultural and fruit growing interests, bringing about an increase in property valuations, in six years, from $9,755,090 to $20,516,873, or more than 110 per cent., that there is a general feeling throughout the county that the operation should be repeated by opening up vast acreages of new citrus growing and farming lands by means of new roads to be financed with the proceeds of another $2,000,000 bond.

The Board of Road Commissioners in Saginaw County, Michigan, in a five-year road building program recently adopted, has determined that no county road shall be constructed less than twenty feet wide. The use of concrete for either foundation or top has been eliminated except in cases where existing old bases can be utilized. Asphaltic penetration, sheet asphalt or asphaltic concrete surfaces will be laid.

The U. S. Post Office Department and the state highway commission are to cooperate to set rural mail boxes a certain distance off the right of way of state roads, to the end that a better road service and also an improved mail service be given.

Because some mail boxes are set too close to the road making overland travel hazardous the commission some time ago, says John D. Williams, director, took the matter up with postal authorities to see if there was a fixed distance for placing same. The fourth assistant postmaster general has written C. Gray, chief engineer of the commission that postal authorities will cooperate with the commission. In view of this cooperation the highway commission has instructed A. H. Hinkle, superintendent of maintenance, to see that his field men take up the matter of the mail boxes with the residents along state roads.

It is agreed by postal and highway officials that mail boxes shall set 5 ft. back off the right-of-way of all improved roads. Estimating that Indiana state roads are 18 ft. wide, then the box should be situated 14 ft. from the center of the road.

"It is very desirable," says Mr. Hinkle, "to have some gravel, cinders or stone in front of the mail boxes so that rural carriers will not have to drive through rut or mud holes in delivering mail. However, it is held that it is the duty of the owner of the mail box to provide such material as needed."

Mr. Hinkle explains that the highway department will keep up the shoulder of the road in front of the box, and says that all his field men have been instructed to see that no mail boxes are put up against the pavement.

A bulletin issued today by Mr. Hinkle instructs field engineers and superintendents to see that all drainage ditches filled up be cleared at once so that proper drainage is afforded. Often these ditches are obstructed by making driveways to property. "We do not wish to be unreasonable but property owners must not obstruct these drainage ways," Mr. Hinkle says.

GOOD ROADS

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Pennsylvania to Organize Traffic Inspection Force

Will Enforce State Laws on Overloading of Trucks and Misuse of Headlights

Harrisburg, Pa., June 16.—Paul D. Wright, Secretary of Highways, today said the Department is laying plans for the inauguration of the traffic inspection force authorized by the Legislature in the motor law signed by the Governor Thursday afternoon.

"As soon as possible," he said, "traffic officers will be placed on Pennsylvania highways. These men are provided for in the section of the Act of 1923 which amends Section 12 of the Act of 1919, governing motor traffic. This amendment authorizes the secretary of highways to employ such men as in his discretion are deemed necessary to the enforcement of the penal provisions of the motor laws. Inauguration of this force will not only result in greater safety to the users of highways, but will conserve the State's resources, because we shall put an end to truck overloading which has been the most active agent in road wear and destruction.

"Our traffic officers will pay particular attention to these evils: The overloading of trucks; speed of motor vehicles—and particularly the speed of trucks; the misuse of headlamps. No truck will be permitted to use Pennsylvania highways when it carries a load greater than that specified for the particular class in which it is registered. No truck will be permitted to travel faster than the rate specified for the class in which it is registered. Our traffic force will drive from the roads that five per cent of vehicle operators who through carelessness, ignorance, or intent, endanger the lives and property of pedestrians and the 95 per cent of drivers which obeys the laws and rules of the road. Pennsylvania highways will be unhealthy places for intoxicated drivers. So-called 'speed-demons' will be curbed. The traffic force will be looking for those drivers who roar through the state utterly regardless of the rights of the other fellow.

"We shall end the glaring headlamp evil. Accidents at night occasioned by the use of illegal lamps are too frequent. At this time nearly 150 headlamp lenses and devices have the approval of the Department. A great many of them are obsolete and dangerous. We shall reexamine the entire number and disqualify those which do not meet modern qualifications. A stop will be put to the use of lamp bulbs greater in candlepower than those permitted for a particular lens. Motorists so careless and indifferent that they use improperly focused headlamps will be rounded up.

"It has been impossible heretofore properly to regulate the use of Pennsylvania highways. The result is the existence of modern Dick Turpins who are as dangerous to road-users as were their ancient predecessors. Because of these outlaws the average man takes his life in his hands when he goes upon a journey—particularly upon Sundays and holidays. The Legislature has given the Department of Highways authority to safeguard the roads and their users—and we propose doing it.

"Pennsylvania's traffic inspection force is to be uniformed. Secretary Wright and Benjamin G. Eynon, Registrar of Motor Vehicles, have not yet decided upon the style or color of these uniforms. The force will be mounted upon motor cycles. Certain members engaged in enforcing the law relating to truck weights will use motor cars in which their road scales will be carried. The number of men in the new force has not been decided. The law did not fix a limit, saying merely that the secretary of highways may empoly such men 'as in his discretion are necessary.'

"Another section of the new motor laws which will result in money saving to the taxpayers is the clause giving the Department authority to regulate the weight of trucks and loads at certain seasons of the year. Secretary Wright and his deputy, William H. Connell, prior to next winter will announce regulations which will govern trucks on stone roads or roads other than a durable type during these seasons of the year when the highways are affected by frost. This is an innovation in Pennsylvania, but a number of other American states have been regulating truck loads for years. During the recent highway conference called by Governor Pinchot a New England highway commissioner told of a fleet of overloaded trucks which in

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passing over a road as the frost was leaving did damage totaling $100,000. Users of Pennsylvania highways during the spring months this year observed on macadam roads the damage done by trucks carrying too great loads.

“It is believed the advance guard of Pennsylvania's traffic inspection force will be on the roads within a month.”

South Carolina Opens Two New Bridges to Traffic

On May 9th the new bridge over the Wateree River on the Garner's Ferry Road was opened to traffic. The bridge itself was completed in December, but the route over it could not be used until the completion of the approaches through the swamp. The way from Columbia to Sumter has been heretofore by Route No. 50 to Camden and thence by Route No. 26, a distance of 64 miles. The new bridge makes available Route No. 3, between Columbia and Sumter, the distance being 45 miles. The first 17 miles from Columbia is a paved road and the road from Sumter towards the bridge is now being paved.

The opening of this bridge provides another route from Columbia to Florence, a route much of which is over a paved surface, but at present the route through Camden to Florence is recommended.

During the month another bridge on Route No. 3 was also opened to traffic. This is the new toll bridge over the Great Pee Dee River between Florence and Marion, known as the Mars Bluff Ferry Bridge. It has been built by Florence and Marion Counties, acting independently.

Three times as much is being spent on local roads as on the main or trunk highways in Minnesota this year, but the trunks being used four times as much as the local roads is the showing on official figures, says an exchange. It is a showing further of how the big majority of people in the state are fooling themselves. The average man is in favor of spending a reasonable amount on roads in his particular locality and unlimited sums, if the money is from the state treasury or other outside source. In this instance the selfish, narrow idea has been overworked. Think of it: Four out of five people using the roads on which only 1 out of 4 road dollars are being used. But we recall Lincoln's saying that begins, “You can fool all the people some of the time—”

Canadian Good Roads Convention Held at Hamilton June 11 to 14

With the good wishes of the Lieutenant Governor of the province of Ontario, the Hon. Harry Cockshutt, the tenth annual convention of the Canadian Good Roads Association opened at the Royal Connaught hotel, Hamilton, on Monday morning, June 11. The opening session was attended by many representative men including two or more of the provincial prime ministers, many of the ministers of highways and public works, members of the Dominion Government and the provincial legislatures, county city and municipal councils and highway officials.

The first business session on Tuesday morning was presided over by the Hon. J. L. Perron, K.C., M.L.C., Minister of Highways Province of Quebec. The program was as follows: Provincial Systems of Highways and Permanent Construction, Geo. Hogarth, chief engineer, Province of Ontario; discussion led by H. M. Necker, Montreal. “Test Road Experiments in the United States,” by J. A. Duchastel de Montrouge, Outremont; discussion opened by Clifford Older, State Highway Engineer, Springfield, Ill. “The Need for Specially Trained Highway Builders,” by Prof. R. de L. French, professor of Highway and Municipal Engineering, McGill University, discussion led by Prof. Laing, University of Toronto: Noon, Kiwanis Club luncheon to distinguished delegates. Afternoon Session, Presiding officer Hon. F. C. Biggs. “Lessons of the Past and Problems of the Future in Highway Development,” by A. W. Campbell, Dominion Commissioner of highways; discussion led by H. S. Carpenter, deputy minister of highways. Province of Saskatchewan; “Who Should Pay for the Road?” Premier Armstrong of Nova Scotia and Premier P. J. Veniot of New Brunswick; “Maintenance Methods and Cost Data, Gravel and Earth Roads,” E. A. James, Toronto, discussion led by B. M. Hill, chief provincial highway engineer, New Brunswick; “Patrol Systems, How Best Conducted,” by L. H. Neilsen, deputy state highway commissioner Lansing, Michigan, discussion led by A. McGillivray, chairman Good Roads Board, Province of Manitoba.

The fourth session on Wednesday morning was presided over by Hon. Dr. Sutherland. The following papers were presented: “Methods for Reconstructing Old Macadam Roads,” by James Pearson, Toronto, discussion led by A. P. Sandles, Columbus, Ohio; “Culverts and Small Bridges,” by E. L. Miles, county road engineer, Lindsay; discussion led by Charles Talbot, engineer, London. “Refined Tar in Construction and Maintenance,” by J. S. Crandell, New York City, discussion opened by A. F. Macallum, Commissioner of works, Ottawa. Afternoon session, presiding officer Hon. C. W. Chisholm. “Cement Concrete, (single track)” by A. M. Jackson, City Engineer Branford, Ont., discussion led by J. C. Wilson, Halton County Road Superintendent, Burlington, Ont.. “Bituminous Surfaces,” by I. W. Patterson, chief engineer, State of Rhode Island, discussion led by Prof. T. Scott, city manager and engineer Niagara Falls. “The Functions of a Suburban Area Commission” by J. A. Mackay, of Hamilton.

Thursday morning session was presided over by the Hon. J. G. Gardiner and the following papers were presented: “The Proper Use of the Highway” by J. F. H. Wyse, secretary of the Ontario Safety League, discussion led by E. H. Thompson, director National Traffic Association, New York; “Tourist Traffic,” John Pierce, passenger traffic manager, Canada Steamship Lines. Montreal discussion led by J. B. Harkin, Commissioner Canadian National Parks, Ottawa.

Gasoline Tax in South Carolina Totals $220,000 Since January

The collections from the three cents a gallon tax on gasoline sales from March 23 to April 30 amounted to $134,706.14, according to figures furnished by the South Carolina Tax Commission.

The amount collected, commencing with January, from the two cents a gallon tax, was announced to be $219,960.06, making $354,666.20 the total amount collected in the four months in 1923.

At the close of the session of the General Assembly in March, 1923, the tax was increased to three cents per gallon, commencing March 23rd —one cent for State Highway Department to be expended for maintenance.

For the nine and a fourth months

of 1923 on the same amount of sales as in 1922, the tax will amount to $1,056,029, and the one-third to the State Highway Department will be $352,000. The amount due to the State Highway Department to April 30 was $44,902.05.

The total amount of the gasoline tax fund in 1923 will be $1,251,600, upon the same amount of sales as for the past twelve months.

Washington Spending $6,000,000 for Highways During 1923

The State Highway Committee of Washington has this spring awarded contracts for $2,664,000 worth of new highway construction. This brings the total value of state road work under way up to $3,500,000, the balance being represented by contracts that were awarded last year. Of this amount $1,571,000 represents the cost of concrete paving for which contracts have been let.

Sixty-four small bridges are included in the present construction program. The first big bridge job that will be let, however, is the bridge and trestle across the Lewis River at La Center which is expected to cost $220,000. This job, designated as Federal Aid Project 110, will be awarded July 31st.

It is expected that an additional $2,500,000 worth of highway contracts will be let by the state before the end of the present building season, says State Highway Engineer James Allen. Plans are being prepared for work to be let June 12 and 26; July 31; August 14 and 21; September 4 and 23.

During the present biennium Mr. Allen estimates that 130 miles of paving will be laid and 380 miles of grading and graveling completed.

West Palm Beach. Hundreds of men, working in crews in an area extending from Okeechobee to the bend of West Palm Beach canal, are clearing right of way and throwing up grade on the route of Conners Highway, which will reduce the distance and lessen the time on the trips between West Palm Beach and Tampa. On his own account W. J. Conners, the promoter of the road, has six excavating machines at work digging ditches along the side of which the road will be constructed, and two machines owned by contractors are doing similar work, and M. F. Myers, one of the contractors, received another machine recently. The excavators run day and night.

Lincoln Highway Association and Indiana State Highway Department Accept Completed Ideal Section

Formal Opening Later After Completion of Lighting and Beautification Work

"The Ideal Section now being completed on the Lincoln Highway in Lake County, Indiana, is justifying all our hopes and efforts in its planning and construction," A. F. Bement, vice-president and secretary of the Lincoln Highway Association, reports upon his return from the site. "That section is the finest and most beautiful piece of road on the Lincoln Highway between New York and San Francisco," said Mr. Bement "it is a revelation as to what can be accomplished at moderate expense by careful planning, expert advice and a consideration of all of the manifold elements which enter into the proper designing of a modern main artery highway."

Recently a group from many parts of the country and representing all of the interests involved in the financing, planning and constructing of the Ideal Section met on the site to accept the paving work proper, which was done by J. C. O'Connor & Sons of Fort Wayne, under the supervision of the association's main contractor Stone & Webster of Boston, Mass.; J. B. Voshell, District Engineer, the Bureau of Public Roads, Department of Agriculture, representing the United States Government which paid $25,000 towards the cost of the work; C. Gray, State Highway Engineer, and William J. Titus, State Bridge Engineer, representing John D. Williams, director of the Indiana State Highway Commission, which bore $20,000 of the expense; A. F. Bement, vice-president and secretary of the Lincoln Highway Association, chairman of the Technical Committee of Highway Experts which designed the section; W. G. Thompson, the Association's Consulting Highway Engineer, who came from Tampa, Fla., for the inspection; J. H. Hood, representing Stone & Webster of Boston, Mass., the Association's main contractor; T. C. Morris, representing Lockwood, Greene & Co., Engineers, the Association's Engineers, and representing also the interests of the United States Rubber Company, which organization thru the interest of its president, Mr. Chas. B. Seger and its vice-president, Mr. J. N. Gunn, president of the Lincoln Highway Association, contributed the major part of the cost of the Ideal Section.

The party spent the day carefully inspecting the paving work which was pronounced by all of the engineers to be an exceptionally fine job. J. C. O'Connor & Sons was highly complimented upon the excellent finish secured on the surface and upon the efficient way the work in general was handled. The Association and its main contractor Stone & Webster, as well as the state and federal government accepted the finished paving job and arranged for the completion of the roadside grading, the erection of the lighting standards, guard rails and the new fences.

The entire party was particularly impressed with the way in which Jens Jensen, the Lincoln Highway Association's landscape architect, was developing the roadsides. Much of the planting already accomplished is now in bloom—grass is springing up on the newly graded shoulder slopes and the Section presents a very beautiful and striking appearance.

Of particular interest in connection with the specifications is the pathway for pedestrians which winds attractively thru the trees along the south side of the road, in the shade, and in addition to being a safety factor which is now receiving very careful consideration from state highway departments in every section of the Union where traffic is heavy, adds materially to the beauty of the Section.

The inspection party looked over the seventeen acre tract recently purchased by the Association and discussed plans for its development as an Ideal Camp Site. The development of this site will await personal inspection by J. Newton Gunn, president of the Lincoln Highway Association and of the United States Tire Company.

Elaborate plans are under consideration by the Association for the formal opening of the Ideal Section as soon as the last touches have been added. Highway engineers from every section of the country will be invited to inspect the finished work at the time the Technical Committee, which designed the Section, makes a final inspection.

Forest Roads in Washington to Receive Federal Funds

Expenditures totaling $96,000 of national forest development funds for the construction of 16 miles of highway in the State of Washington have just been approved by the Secretary of Agriculture, according to an announcement made by the Forest Service, United States Department of Agriculture.

One of these road-building projects is the Baker River road in Whatcom County and lies within the Washington National Forest. The project is 9 miles in length and will run between the south boundary of the forest to the south end of Baker Lake. The sum of $46,000 has been allotted for the work. The road when completed will open up a large interior region that can now be reached only by trail, thus being of great value from a protective as well as a recreational standpoint. It will also be of value to the United States Fish Hatchery at Baker Lake.

The other project consists of 7 miles of the Middle Fork Snoqualmie Highway, located partly within the Snoqualmie National Forest and partly within King County. The sum of $50,000 has been appropriated for the construction work, King County cooperating to the extent of building a bridge over the Pratt River.

This highway when completed will be of immense value to the Snoqualmie National Forest from the protection standpoint, as it will open up a large interior region containing heavy timber.

The Secretary of Agriculture has also authorized an additional $10,000 of the Section 8 Highway fund for the construction of the Mount Baker road in Whatcom County, Washington, and within the Washington National Forest. This additional allotment brings the total amount allotted for this highway up to $127,000, two-thirds of which is from Federal funds and one-third of which is furnished by Whatcom County.

In 1922, according to the figures from U. S. Bureau of Mines, the production of gasoline in the United States was 6,202,234,613 gallons and the domestic consumption was 5,382,504,177 gallons; the excess of supply over demand being 819,730,436 gallons.

A. A. A. To Back Good Roads Movement Announces New President

Legislative activities both state and national on behalf of good roads and in support of motor vehicle laws which are fair to the individual automobile owner will constitute a prominent part of the American Automobile Association's program for the coming year, according to a statement by Thomas P. Henry, of Detroit, new president of the A. A. A., at an informal meeting held at Washington. National problems will be handled by the national organization and local matters affecting the motorist in the various states will be taken up through the state association or clubs of such state which are affiliated with the A. A. A.

Highway legislative activities, according to Mr. Henry, will include an intensive program directed toward eliminating insofar as possible the personnel of the various highway boards and commissions from partisan politics. Decision to concentrate on this problem was reached after a study of statistics which show that highway departments of eighteen states have been radically changed during the past few months.

"We feel," said Mr. Henry, "that the building and maintenance of highways is of too great importance to be interrupted by a complete change in administration. Adequate highways are a boon to the whole people and partisan politics should play no part in their construction. We feel that every highway department should be operated on a businesslike basis with the best obtainable personnel in charge, in order that the people who pay for the roads may get the utmost for their money."

Closer cooperation with other national organizations was also suggested by President Henry as a part of the year's activities for the A. A. A. "Every cause advocated by the American Automobile Association," he said, "is altruistic in purpose and there is no reason why we should not have the cooperation of every great national organization in support of the measures we advocate. Good roads benefit everybody; unfair taxes on the automobile affect every class of people; measures which give the motorist a square deal are of interest to every national organization. As the activities of the A. A. A. are confined solely to advocating beneficial measures and as Secretary Wallace so aptly expressed it 'the A. A. A. has no ax to grind' there is no reason why we cannot cooperate with other organizations and receive in turn their cooperation."

Three Highway Contractor Organizations Join A. G. C.

The Michigan Road Contractors Association with a membership of 60 have, through their secretary, recently applied for a Chapter charter from the A. G. C.

The Board of Directors of the Associated West Virginia Highway Contractors have passed a resolution to affiliate with the A. G. C., and have applied for a charter as a State Highway Chapter. This Association has 37 members.

An application from the Builders' Association of Chicago for a charter for a Chicago chapter of the A. G. C. has just been received and will be acted upon at once. The present membership is 36.

Pensacola, Fla. Much progress is being made for several paving projects in various parts of the county, according to County Commissioner Gandy, who returned this afternoon from a long trip through the county. He said that he expected the Gerkin contract, which is two miles westward from the city limits, to be completed quite soon. Various obstacles have caused regrettable delay on this project, and a great deal of inconvenience was caused thereby to hundreds of motorists from the detouring. Mr. Gandy said that during the month the Fulghum contract, which is that 10 miles immediately north of the city, was featured the past month by more than a mile of concrete pouring. This was done despite the bad weather and despite the fact that needed material was hard to get. One and one half miles a month are expected to be poured hereafter.

High water mark in the matter of lettings by the Ohio department of highways will be reached during the month of June, with lettings scheduled for the 15th, 19th and 22d of the month, and a possibility of another letting covering a few projects during the last week of the month. The number of jobs to be offered at the three lettings is about sixty and the estimated cost of the work to be offered is between four and five million dollars, probably nearer the latter amount.

WANTED COPIES OF GOOD ROADS

We desire the following copies of Good Roads for which we will pay 10c a copy:

Dec. 26, 1914
June 26, 1915
July 13, 1918
Oct. 12, 1918
Nov. 30, 1918
Dec. 7, 1918
Jan. 11, 1919
Apr. 26, 1919
Oct. 22, 1919
Feb. 25, 1920
Aug. 25, 1920
Sept. 7, 1921
Sept. 27, 1922
Nov. 1, 1922
Mar. 14, 1923

American Gas Accumulator Co. Open New York Office

The American Gas Accumulator Company, of Elizabeth, N. J., who make Traffic Beacons and Highway Lighthouses, have opened a New York office at 100 East 42nd street, in the new Pershing Square Building, opposite the Grand Central Station.

In an effort to solve the traffic problem and reduce the number of automobile accidents, this company has developed a Traffic Engineering Department which makes a survey of municipal traffic conditions, bringing to bear known engineering principles in other fields. It is an interesting point to know that these Flashing Traffic Beacons and Highway Lighthouses operate in the same manner as the Government Buoys and Lighthouses in the harbors of the United States, and other parts of the world. They are sister lights to the recently installed Aviation Routing Beacons of the U. S. Air Mail Service, located every three miles from Chicago to Cheyenne to guide the transcontinental night flyers.

Some of us who make a lot of noise about the expense would likely make even more if we had to go back to the old roads of only ten years ago.—LeSuer Center Leader-Democrat.

Local merchants are already reporting trade from tourist traffic and almost any citizen can observe tourist parties stopping here to spend their money. All of which indicates that the local man who recently wrote a letter to the Journal-Chronicle, declaring that we should develop only the rural roads leading into Steele county and that we should let the state highways go hang, was all wrong.—Owatonna Journal-Chronicle.

* * *

Some complaint is heard now and then because automobile tax money is spent upon the trunk highways, which means the roads that "go somewhere", and therefore the farmers residing in remote places get very little benefit, but it must be remembered that the "through" roads must be built first if there is to be orderly construction. Any other course would be as ridiculous as for a railroad to build its sidetracks and come along later with the main line.—Thief River Falls Tribune.

NEW JERSEY

Bids will be received by the State Highway Commission of New Jersey at Trenton, N. J., on July 9, 1923, for the construction of the following: Route No. 1, Section No. 12, Rahway avenue, Elizabeth, in the County of Union. Estimated 4,360 cu. yd. of excavation, and 24,550 sq. yd. of sheet asphalt pavement on a 6 in. concrete base.

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HIGHWAY CONTRACT NEWS

CALIFORNIA

Bids will be received at the office of the California Highway Commission, 515 Forum Building, Sacramento, Cal., until July 2, 1923, for construction of portions of State Highway, as follows: Santa Clara County, between five miles east of Gilroy and San Felipe (IV-SCI-32-A), about 4.5 mi. in length, to be graded and surfaced with gravel. State Highway Engineer's estimate: 40,000 cu. yd. roadway excavation without classification, 500 cu. yd. culvert excavation without classification, 9000 cu. yd. gravel surface 450 cu. yd. Class A Portland cement concrete (culverts and monuments), 1187 lin. ft. 18 in. corrugated metal pipe. San Mateo County, on Crystal Springs Dam near San Mateo on the Skyline Boulevard (IV-SM-55-B), a reinforced concrete bridge consisting of twenty reinforced concrete girder spans with the necessary bents, abutments and wing walls. State Highway Engineer's estimate: 1300 cu. yd. Class A Portland cement concrete in place, 100 cu. yd. Class C Portland cement concrete in place, 275,000 lb. reinforcing steel in place. Plans may be seen, and forms or proposals, bonds, contract and specifications may be obtained at the said office and they may be seen at the offices of the Division Engineers at Los Angeles and San Francisco, and at the office of the Division Engineer of the division in which the work is situated. The Division Engineers' offices are located at Willits, Dunsmuir, Sacramento, San Francisco San Luis Obispo, Fresno, and Los Angeles.

IDAHO

Bids will be received until June 29th, 1923, at office of Bureau of Public Roads, Smead-Simons Building, Missoula, Montana, for the following road project:

Bonners Ferry-Leonia-State Line section—Forest Road project located within and adjacent to the Pend O'Reille National Forest Boundary County, Idaho. Length 8.06 miles. Quantities approximately 37.8 acres clearing, 111,000 cu. yd. excavation, crushed rock or gravel surfacing 14,200 cu. yd., 88.2 cu. yd. cement rubble masonry.

KENTUCKY

State Highway Department, Frankfort, Ky., is now preparing plans for grading and draining the Hazard-Whitesburg road from Christopher to Jeff Station in Perry County, State Project No. 4, Section A, also Federal Aid Project No. 104. 3.996 mi.

State Highway Department, Frankfort, Ky., is preparing plans for the grading and surfacing of the Whitley City-Somerset road from Whitley City to the Pulaski County line in McCreary County, State Project No. 22, Section D. 14.581 mi.

State Highway Department, Frankfort, Ky., is now preparing plans for the construction of 2-100 ft. steel span bridge with trestle approaches over North Fork of Kentucky River about three miles north of Hazard, Ky., in Perry County, on State Project No. 4, Federal Aid Project No. 103.

Also 2-100 ft. steel spans with trestle approaches over same river about one mile north of Hazard, Ky., in Perry County on same project.

Also 3-100 ft. steel spans and 2-40 ft. concrete T beams over North Fork, Kentucky River, about one mile south of Hazard, Ky., in Perry County. on State Project No. 4, Section A, Federal Aid Project No. 104.

Also 2-100 ft. steel spans and 2-40 ft. T concrete beams over same river on the same project near Jeff Station, Ky.

Address Joe S. Boggs, State Highway Engineer, Frankfort, Ky.

State Highway Department, Frankfort, Ky., is now preparing plans for grading 11.32 mi. of the Salyersville-West Liberty road from Salyersville to Morgan County line in Magoffin County.

State Highway Department, Frankfort, Ky., is now preparing plans for the construction of 27.8 mi. of the Harlan-Whitesburg road, State Project No. 6 Harlan County.

State Highway Department, Frankfort, Ky., is now preparing plans for the construction of 1.0 mi. of the Lexington-Georgetown road, State Project No. 5, Fayette County. This is an experimental road and will include 6 types of surfacing.

Address Joe S. Boggs, State Highway Engineer, Frankfort, Ky.

Letcher County, Kentucky, Fiscal Court on June 11th, voted to submit a $300,000 bond issue to the vote of the people during August. The Fiscal Court of this county, also, plans to construct the highway between Jenkins and Pound Gap. Address the County Judge at Whitesburg, Kentucky.

MICHIGAN

Bids will be received at the office of the Board of County Road Commissioners of Jackson County 132 W. Ganson Street, Jackson, Michigan, until July 9, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 0.568 mi. of road in Leoni Township, Jackson County, Michigan. The work will consist of shaping the road and surfacing to a width of 18 ft. with concrete pavement (reinforced) and sheet asphalt pavement.

Bids will be received at the office of the Board of County Road Commissioners of Macomb County, Mt. Clemens, Michigan, until July 12, 1923, by Frank F. Rogers State Highway Commissioner, for improving 5.581 mi. of road in Lennox and Chesterfield Townships, Macomb County, Michigan, as follows: F. A. 121—4.577 mi. of road in Lennox and Chesterfield Townships; S. T. L. 19-14—1.004 mi. in Lennox Township. The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 20 ft. for road No. 121 and 18 ft. for road No. 19-14 with concrete pavement. Alternate bids will be received for bituminous concrete or sheet asphalt pavement.

Bids will be received at the office of the Board of County Road Commissioners of Charlevoix County, Court House, Charlevoix, Michigan, until July 11, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 10.090 mi. of road in Warner Township, Antrim County, and Boyne Valley Township, Charlevoix County, Michigan, as follows: F. A. 102, Section A—5.977 mi. in Warner Township, Antrim County; F. A. 102, Section B—4.113 mi. in Boyne Valley Township, Charlevoix County. The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 16 ft. with one course gravel. Bids will be received by section or for both sections together.

Bids will be received at the office of the Board of County Road Commissioners of Emmet County, Court House. Petoskey, Michigan, until July 10, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 1.940 mi. of road in the City of Petoskey, Emmet County, Michigan, as follows: S. T. L. 11-48—0.542 mi. City of Petoskey; S. T. L. 13-45—1.398 mi. City of Petoskey. The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 20 ft. with concrete pavement. Alternate bids will be received for surfacing with bituminous concrete or sheet asphalt pavement.

Bids will be received at the office of the Board of County Road Commissioners of St. Joseph County, Court House, Centreville, Michigan, until July 10, 1923 by Frank F. Rogers, State Highway Commissioner, for improving 2.620 mi. of road in Constantine, White Pigeon and Mottville Townships, St. Joseph County, Michigan. The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 18 ft. with concrete pavement. Alternate bids will be received for bituminous concrete or sheet asphalt pavement.

Bids will be received at the office of the Board of County Road Commissioners of Macomb County, Court House, Mt. Clemens, Michigan, until July 12, 1923, by Frank F. Rogers, State Highway Commissioner, for improving a section of road in the Village of Romeo, being 0.598 mi. of the following description: The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 20 ft. with concrete pavement. Alternate bids will be received for bituminous concrete or sheet asphalt pavement.

Bids will be received at the office of the Board of County Road Commissioners of Macomb County, Court House, Mt. Clemens, Michigan, until July 12, 1923, by Frank F. Rogers, State Highway Commissioner, for improving the north 0.665 mi. of way in the Village of Romeo. The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 20 ft. with concrete pavement. Alternate bids will be received for bituminous concrete or sheet asphalt pavement.

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the Board of County Road Commissioners of Grand Traverse County, Court House, Traverse City, Michigan, until July 12, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 1.651 mi. of road in the Village of Fife Lake and Fife Lake Township, Grand Traverse County, Michigan. The work will consist of shaping the road, constructing the necessary drainage structures and surfacing to a width of 20 ft. with concrete pavement and 16 ft. with gravel surface (Class B).

Bids will be received at the Office of the Board of County Road Commissioners of Mason County, Court House, Ludington, Michigan, until July 6, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 5.739 mi. of road in Mason County, Michigan, as follows: F. A. 104—5.227 mi. in Pere Marquette and Amber Townships; S. T. L. 11-37—0.512 mi. in the Village of Scottville. The work will consist of shaping roads, constructing the necessary drainage structures, and surfacing to a width of 18 ft. on Federal Aid Road No. 104 and to a width of 20 ft. on State Trunk Line Road No. 11-37 with concrete pavement. Alternate bids will be received for surfacing with bituminous concrete pavement on Trunk Line Road No. 11-37. Plans may be examined and instructions to bidders, specifications and proposal blanks obtained at the Office of the Board of County Road Commissioners of Mason County, Court House, Ludington, Michigan; at the District Office of the State Highway Department, Cadillac, Michigan; and at the Office of the State Highway Department, Lansing, Michigan.

Bids will be received at the Office of the Board of County Road Commissioners of Monroe County, Court House, Monroe, Michigan, until July 3, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 14.654 mi. of road in Bedford, Erie, LaSalle and Monroe Townships, Monroe County, Michigan. The work will consist of shaping the road and constructing the necessary drainage structures. Bids will be received by section or for all sections together. Plans may be examined and instructions to bidders, specifications and proposal blanks obtained at the Office of the Board of County Road Commissioners of Monroe County, Court House, Monroe, Michigan; at the district office of the State Highway Department, Press Building, Ann Arbor, Michigan; and at the office of the State Highway Department, Lansing, Michigan.

Bids will be received at the Office of the Board of County Road Commissioners of Washtenaw County, Court House, Ann Arbor, Michigan, until July 2, 1923, by Frank F. Rogers, State Highway Commissioner, for improving 4.142 mi. of road in Washtenaw County, Michigan, as follows: 17-6, A—1.170 mi. in City of Ann Arbor and Ann Arbor Township; 17-6, B—0.516 mi. in the City of Ypsilanti; F. A. 74, A—2.456 mi. in Ann Arbor and Scio Townships. Bids will be received on all sections together. The work will consist of shaping the roads, constructing the necessary drainage structures, and surfacing to a width of 20 ft. with concrete pavement. Alternate bids will be received for surfacing with either bituminous concrete or sheet asphalt pavement. Plans may be examined and instructions to bidders, specifications and proposal blanks obtained at the office of the Board of County Road Commissioners of Washtenaw County, Court House, Ann Arbor, Michigan; at the District Office of the State Highway Department, Press Building, Ann Arbor, Michigan; and at the Office of the State Highway Department, Lansing, Michigan.

MONTANA

Bids will be received until June 29, 1923, at office of Bureau of Public Roads, Smead-Simons Building, Missoula, Montana, for the following road projects:

Libby-Rexford section—Forest Road project located within the Kootanai National Forest, Lincoln County. Length, 10.4 miles. Quantities, approximately 50.5 acres clearing, 50,000 cu. yd. excavation, 15,300 cu. yd. crushed rock or gravel surfacing, 162 cu. yd. concrete for bridges, 3600 lb. reinforcing steel, 102 cu. yd. rubble masonry. Located near Ural, Montana.

West Gallatin-Eldridge section—Forest Road project located within the Gallatin National Forest in Gallatin County. Length 9.79 miles. Quantities, approximately 15.4 acres clearing, 71,000 cu. yd. excavation, crushed rock or gravel surfacing 17,200 cu. yd. concrete for bridges and culverts 52 cu. yd., 5,520 lb. reinforcing steel, 110 cu. yd. cement rubble masonry.

MISSISSIPPI

Bids will be received by the Board of Supervisors of Yalobusha County, Mississippi, at the Office of the Chancery Clerk, Coffeeville, until July 2, 1923, for a bridge over Yocona Canal on Federal Aid Project No. 45, the same being a part of State Trunk Road between Grenada and Memphis. The principal items of work are approximately as follows: 146.15 cu. yd. Class A concrete, 6850 lb. reinforcing steel, 5000 ft. B. M. creosoted lumber, 4740 ft. B. M. untreated lumber, 144 lin. ft. creosoted piling, 768 lin. ft. foundation piling, 1 100 ft. steel span. Address State Highway Engineer, Jackson, Miss.

Bids will be received by the Board of Supervisors of Chickasaw County, Mississippi, at the Office of the Chancery Clerk, Houston, Miss., until July 2, 1923, for a state project between Woodland and the Webster County line. The length of road to be improved or constructed is 7.97 mi. and the prinicpal items of work are approximately as follows: 6.12 acres clearing and grubbing, 27,290 cu. yd. common excavation, 33,306.8 cu. yd. borrow excavation, 217.5 lin. ft. 15 in. D. S. V. C. pipe, 295 lin. ft. 18 in. D. S. V. C. pipe, 299.7 cu. yd. Class A concrete in culverts, 31.44 cu. yd. Class C concrete in culverts, 29,707 lb. reinforcing steel in culverts, 12,576 cu. yd. gravel 1 mi. haul, 83,494 cu. yd. gravel ½ mi. overhaul, 7.97 mi. Bermuda sod, 51,780 ft. B. M. creosoted lumber in bridges, 2360 ft. B. M. untreated lumber in bridges, 2420 lin. ft. creosoted piling in bridges. Address State Highway Engineer, Jackson, Miss.

Bids will be received by the Board of Supervisors of Oktibbeha County, Miss., at the Office of the Chancery Clerk, Starkville, until July 6, 1923, for Federal Aid Project No. 144, the same being a part of State Trunk Road between Starkville and A. & M. College. The length of road to be improved or constructed is 1.736 mi. and the principal items of work are approximately as follows: 800 cu. yd. common excavation, 265 cu. yd. borrow excavation, 360 lin. ft 18 in. T. S. V. C. pipe, 12.48 cu. yd. Class C concrete in culverts, 10,580 sq. yd. concrete paving. Alternate bids will be received on the following instead of concrete paving as shown above: 10,580 sq. yd. sheet asphalt paving on asphaltic clay gravel binder course, 10,580 sq. yd. Kentucky Rock asphalt paving on crushed stone or slag binder course. Section B: 2283 cu. yd. common excavation, 80 cu. yd. borrow excavation, 32.5 lin. ft. 18 in. T. S. V. C. pipe, 108.95 cu. yd. Class A concrete in culverts, 2.08 cu. yd. Class C concrete in culverts, 10,939 lb. reinforcing steel, 1676 cu. yd. gravel, 1 mi. haul, 424 units gravel ½ mi. overhaul. Bridges over 20 ft. span: 13,500 lb. structural steel. Bids will be received at the same time for furnishing 2514 tons of road gravel f. o. b. cars at A. & M. College, Mississippi. Address State Highway Engineer, Jackson, Miss.

NORTH DAKOTA

Bids for the construction of a State Highway south from the Wells County Line in R 73 W will be received by the State Highway Commission and the Board of County Commissioners at the Court House at Steele, N. D., until July 6, 1923. Contemplated work consists of 5.936 mi. of earth road improvement involving approximately: 3.0 acres clearing and grubbing, 3.0 acres plowing and harrowing, 47,354 cu. yd. earth excavation, 1955 cu. yd. rock excavation, 1192 cu. yd. Stas overhaul, 145 cu. yd. riprap, 35.55 cu. yd. (grouted) riprap, 337 sq. yd. cobble gutter (sand joints), 1710 lin. ft. wire rope guard rail, 82 wood guard posts, 1360 lin. ft. snow fence, furnishing and delivering and hauling and installing pipe culverts as follows: 1282 lin. ft. 18 in. diam., 306 lin. ft. 24 in. diam., 21.40 cu. yd. Class A concrete and 1577 lb. metal reinforcement.

SOUTH CAROLINA

Bids will be received until July 6, 1923, at the office of the Board of County Commissioners of Lancaster County, Lancaster, S. C., for the construction of 3.17 mi. of State Route No. 9, approaches to Cook's Mill Bridge over Lynches River, in Lancaster and Chesterfield Counties. The work to be done includes the necessary clearing and grubbing, installation of necessary drainage structures, 18,748 cu. yd. common excavation, 7359 cu. yd. rock excavation and 9927 cu. yd. top soil surfacing.

SOUTH DAKOTA

South Dakota State Highway Commission will receive bids at their office at Pierre, South Dakota, on June 26, 1923, for road and bridge work, as follows:

Grading of Federal Aid Project No. 114, Bon Homme County: 50,940 cu. yd. common excavation, 11,457 cu. yd. Stas. overhaul of excavation, 1135 lin. ft. concrete pipe to be hauled and laid, 119.37 cu. yd. Class A concrete, 11,085 lb. reinforcing steel, 348 cu. yd. structural excavation. Time of completion: December 1st, 1923.

Grading of Federal Aid Project No. 144, Union County: 61,000 cu. yd.

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common excavation, 61,472 cu. yd. Stas. overhaul of excavation, 1435 lin. ft. installation of concrete pipe, 306.27 cu. yd. Class A concrete, 28,112 lb. reinforcing steel, 433 cu. yd. structure excavation, 186 cu. yd. hand placed riprap. Time of completion: December 1, 1923.

Grading of Federal Aid Project No. 130 A, Custer County; 14,164 cu. yd. solid rock excavation, 16,761 cu. yd. loose rock excavation, 9159 cu. yd. common excavation, 9853 yd. Stas. overhaul of excavation, 1138 lin. ft. corrugated metal pipe, 1704 lin. ft. wood piling, 224 cu. yd. structure excavation, 17,650 F. B. M. lumber. Time of completion: December 1, 1923.

Construction of viaduct on State Aid Project No. 73, Tripp County: 35.5 cu. yd. Class A concrete, 1756 lb. gas pipe handrail, 40.0 cu. yd. Class D concrete, 640 lin. ft. timber piling, 11,958 lb. reinforcing steel, 96 cu. yd. structure excavation. Time of completion: November 1, 1923.

TEXAS

Bids for the improvement of certain highways in Lamar County, will be received at the office of John S. Baker, County Auditor, at Paris, Texas, until June 30, 1923. Work to be done: Construction of 2.41 mi. 18 ft. concrete pavement 6 in.-9 in., Bates section. Approximate quantities: 3025.7 cu. yd. earth roadway excavation, 6376.4 cu. yd. earth borrow excavation, 554.1 sta. yd. earth overhaul, 25,535.07 sq. yd. concrete pavement.

WASHINGTON

Bids will be received at the office of the State Highway Committee, Olympia, Washington, until July 10, 1923, for the following improvements:

Hama Hama River bridges, Fed. Aid Project No. 108—Two reinforced concrete arches each 150 feet long. Quantities involved, approximately 1200 cu. yd. excavation, 1500 cu. yd. concrete, 215,000 lb. reinforcing bars, 5000 lin. ft. piling, 560 lb. copper seals, 22,400 lb. steel castings.

Riverside-Omak section, Fed. Aid Project No. 116—In Okanogan County 6.87 miles grading and crushed gravel surfacing. Quantities involved approximately 64,000 cu. yd. excavation, 10,115 cu. yd. crushed gravel surfacing, 60 cu. yd. concrete, 3,720 lb. steel reinforcing bars.

Pomona-Selah—Surfacing with crushed rock about 6.3 miles of the Inland Empire in Yakima County.

Raymond Embankment — Embankment approach to Raymond bridge on Ocean Beach highway in Pacific County, 0.3 mile long.

Fallon Bridge — Constructing steel bridge approximately 360 feet long, across Yakima River, near Richland, in Benton County.

Furnishing approximately 5,000 cu. yd. of crushed rock in bunkers at quarry site in Benton County. Address James Allen, State Highway Engineer, Olympia, Wash.

WYOMING

Bids will be received by the Wyoming State Highway Department, Capitol Building, Cheyenne, Wyo., until June 29th, 1923, for the construction of the following projects:

F. A. Project No. 142A—involving the grading surfacing, and culvert construction on 5.29 miles of the Yellowstone Highway immediately south of Glendo in Platte County.

F. A. Project No. 151A—involving the grading, surfacing, bridge and culvert construction on 9.219 miles of the Newcastle-Moorcroft Road adjoining Newcastle in Weston County. Separate bids may be submitted for the grading and surfacing or for the construction of the bridges and culverts consisting of one 80 ft. steel span with pile trestle approaches, one 76 ft. pile trestle, two 57 ft. pile trestle, one 19 ft. pile trestle, and one 5 ft. by 4 in. concrete box culvert.

F. A. Project No. 148—involving the grading, surfacing and culvert construction on 4.049 miles of the Lincoln Highway between the Medicine Bow River and Carbon-Albany County Line in Carbon County.

Plans and specifications may be seen at the office of the State Highway Superintendent, Cheyenne, or at the offices of the Highway Engineers as follows: Project No. 142A—P. W. Warren, Lingle, Wyo. Project No. 151A—C. O. Diffenderfer, Upton, Wyo. Project No. 148—R. J. Templeton, Rock Springs, Wyo.

WISCONSIN

Baraboo. County State Road and Bridge Committee of Sauk County will receive sealed bids until July 3, 1923, at Village Hall in Ableman, Wisconsin, for building the Ableman bridge, Town of Excelsior, Sauk County, Wis., a three 50-ft. span concrete deck girder type, with 45 deg. skew, 24 ft. roadway, baluster railing: Estimated quantities: Concrete 579.3 cu. yd.; balusters, 294; piling, 144 ft., 20 ft. long; reinforcing steel, 89,110 lb.; structural steel 4500 lb.; cement in place, 870 bbl., to be furnished by contractor. Address Wm. Halbersleben, Commissioner.

Monroe. Sealed bids will be received by the County State Road and Bridge Committee of Green County, until July 6, 1923, at Village Hall, Albany, Wis., for building the Sugar River Bridge Village of Albany, Green County, a two 65-ft. span concrete deck girder bridge, 24-ft. roadway with one 6 ft. sidewalk and baluster railing. Estimated quantities: Concrete 867.3 cu. yd.; reinf. steel, 104,630 lb.; cast steel 5,280 lb.; balusters, 266; cement in place, 1,300 bbl., to be furnished by county. Address C. J. Smith, Commissioner.

Madison. Wisconsin Highway Commission at meeting held Saturday, June 16, 1923, decided to reconstruct the bridge over the Wisconsin River in city of Stevens Point on Clark street, with a concrete bridge of 500 ft. length, 30 ft. roadway, two 6 ft. sidewalks. Estimated cost $180.000, city of Stevens Point, Portage County, and State of Wisconsin each to pay one-third. Wisconsin Highway Commission will prepare plans. Address W. C. Buetow, Bridge Engineer.

BIDS RECEIVED

MICHIGAN

The Michigan State Highway Department awarded contracts on June 9 as follows: Road No. 11-32B, Oceana, F-Rein. 18 ft., 1.342 miles, New Era Road Bldg. Co., New Era, Michigan, $28399.07; 11-47, VanBuren South Haven F-Rein. 18 ft., 0.499 miles, Wm. Neale & Son,. Kalamazoo, Michigan, $11396.79; 51-5,B, Ottawa, G. & S., 0.063 miles, Kemme & Diepenhorst, Zeeland, Michigan, $1405.63; 65-6,A, Monroe, F, 18 ft., 5.300 miles, Hillding Const. Co., Ida, Michigan, $145663.61; 16-21, Wayne, F-Plain, 20 ft., 5.170 miles, Wayne County Road Comm., Detroit, Michigan, $262193.42; 81-7, Sanilac, Culvert, Dan Healy, Bad Axe, Mich., $1708.88. 118, Muskegon F. Rein, 18 ft., 4.009 miles Muskegon County Road Comm., Muskegon, Mich., $68990.12; 52 C, Kalamazoo, G. & D. S., 0.701 miles, Sturgis Road Improvement Co., Sturgis, Michigan, $7912.92.

NEW YORK

Bids for the reconstruction of the following highways were received by the State Commission of Highways at its office, No. 55 Lancaster Street, Albany, N. Y., on June 15, 1923.

R. C. No. 1363, Highway No. 5144, Orange County, 2.00 mi. (Engineer's estimate for the work $84,855.50); Schunnemunk Cons. Co., Highland Mills, N. Y., $81,587.70.

R. C. No. 1364, Highway No. 159, Orange County, 1.96 mi. (Engineer's estimate for the work, $95,056.11); H. H. Smith, Middletown, N. Y., $93,876.11.

R. C. No. 1365, Highway No. 1372, Albany County, 1.43 mi. (Engineer's estimate for the work, $52,157.45); Pelham & Shaffer, Schenectady, N. Y., $51,601.45.

R. C. No. 1375, Highway No. 610, Saratoga County, 2.42 mi. (Engineer's estimate for the work, $114,604.50); John B. Dower, Ballston Spa., N. Y., $102,982.00; Michael J. Nugent, Albany, N. Y., $106,940.50; Lathrop, Shea & Henwood Co., Buffalo, N. Y., $107.086.00; Collins Brothers, Mechanicsville, N. Y., $108,579.05.

R. C. No. 1366, Highway No. 184, Jefferson County, 2.95 mi. (Engineer's estimate for the work, $104,162.85); J. C. Haynes, Watertown, N. Y., $99,476.35; Spellman-Oliver Co., Chateaugay, N. Y., $101,062.85; Pathfinder Cons. Co., Inc., Fulton, N. Y., $101,354.85.

R. C. No. 1380, Highway No. 5209, Herkimer County, 1.02 mi. (Engineer's estimate for the work, $49,054.50); Harry W. Roberts Co., Utica, N. Y., $45,883.50; Municipal Cons. Co., Utica, N. Y., $46,292.00; J. E. Flood. Co., Hudson Falls, N. Y., $47,474.50; Richard Hopkins Co., Albany, N. Y., $47,617.00; C. H. Sage, Batavia, N. Y., $48,112.50.

R. C. No. 1378, Highway No. 5014, Madison County, 1.30 mi. (Engineer's estimate for the work, $70,808.50); Harry W. Roberts & Co., Utica, N. Y., $67 457.00; C. H. Sage, Batavia, N. Y., $68,558.50; S. K. Johnson, Norwich, N. Y., $69,581.50; Wm. M. Bronk, Hudson Falls, N. Y., $70,091.00; H. G. Hotchkiss, Jr., Albany, N. Y., $770,773.00.

R. C. No. 1379. Highway No. 108, Montgomery County, 1.65 mi. (Engineer's estimate for the work, $78,562.80); Michael J. Nugent, Albany, N. Y., $73,922.80; Harry W. Roberts & Co., Utica, N. Y., $76,345.30.

R. C. No. 1376, Highway No. 5148, Broome County, 3.68 mi. (Engineer's estimate for the work, $177,143.50);

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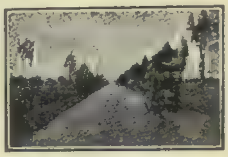

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C. H. Sage, Batavia, N. Y., $166,348.50; Stento & Serafini, Binghamton, N. Y., $172,093.50; Tyne & Willey, Binghamton, N. Y., $176,213.50.

R. C. No. 1377, Highway No. 5261 & 5013, Chenango County, 1.61 mi. (Engineer's estimate for the work, $67,952.70); Parlor City Cons. Co., Inc., Binghamton, N. Y., $61,850.20; Frank Lewis & Sons, Afton, N. Y., $62,940.20; Earl C. Jones, Great Valley, N. Y., $64,639.80; Hughie, Manning & Perry, Inc., Albany, N. Y., $65,446.81; F. D. Griffin & Co., Norwich, N. Y., $65,838.20; Tyne & Willey, Binghamton, N. Y., $66,664.70; S. K. Johnson, Norwich, N. Y., $66,672.00.

Grade Crossing Elimination—Highway No. 1613-A, Broome Co., 0.37 mi. (Engineer's estimate for the work, $25,689.50); Parlor City Cons. Co., Inc., Binghamton, N. Y., $22,893.00; Lathrop, Shea & Henwood Co., Buffalo, N. Y., $23,697.00; O'Day & Ambrose, Binghamton, N. Y., $23,979.50; G. D'Angelo, Binghamton, N. Y., $24,468.02; Stento & Serafini, Binghamton, N. Y., $25,192.10.

WISCONSIN

Madison. Wisconsin Highway Commission awarded the following road contracts:

To Campbell Construction Co., Minneapolis, Minn., (street address not given) the Askeaton-Greenleaf road, Project No. 322, Brown county: Excav. earth, 12,236 cu. yd. at .78, $9,544.08; borrow 12 cu. yd. at $1.50, $18; concrete surfacing, 23,308 sq. yd. at $1.18, $27,503.44; cement in place, 8000 bbl. at .25, $2000; concrete Class A, culverts, 148.3 cu. yd. at $20, $2,960; guard rail, Type A, 800 lin. ft. at .50, $400; Type C, 52 posts at $1, $52; curb, 455 lin. ft. at .15, $68.25; riprap, 90 cu. yd. at $3.25, $292.50; catch basins, 2 at $60, $120; reinforcing steel, 30,830 lb. at .045, $1387.35; 15 in. corrug. metal pipe, 155 lin. ft. at $2.15, $333.25; 18 in. corrug. metal pipe, 256 lin. ft. at $2.55, $652.80; 24 in. corrug. metal pipe, 140 lin. ft. at $3.60, $504. Total contract $45,941.67.

To Campbell Construction Co., Minneapolis, Minn., the De Pere-Greenleaf road, Project No. 321, Brown county: Clearing, .66 acres at $100, $66.00; excav. earth, 14,544 cu. yd. at .78, $11,344.32; ditching 194 cu. yd. at .75, $145.50; borrow 121 cu. yd. at $1.50, $181.50; concrete surfacing, 23,325 sq. yd. at $1.48, $34,521.00; cement in place 8,210 bbl. at .30, $2463.00; concrete Class A, culverts, 133.1 cu. yd. at $20, $2662.00; in bridges, 196.5 cu. yd. at $20, $3930.00; Type B guard rail, 830 lin. ft. at .50, $415; Type C, 71 posts at $1.00, $71; grubbing, .66 acres at $100, $66.00; riprap, 45 cu. yd. at $3.50, $157.50; reinforcing steel, 29,480 lb. at .045, $1326.60; 18 in. corrug. iron pipe, 30 lin. ft. at $2.55, $76.50. Total contract $57 425.92.

To W. E. Ule, Stevens Point, Wis., the New Lisbon-Mauston-Kilbourn road, Project No. 280, Juneau county; total contract $34,272.65.

Sparta. County state road and bridge committee of Monroe county awarded the following bridge contracts:

Village of Wilton, Gooseville bridge, to R. Blado, Tomah, $8,050.

Town of Tomah, Snowberry bridge, R. Blado, Tomah $3,000.

Town of Adrian, Foth No. 2 bridge, to John Kruck, Norwalk, Wis., $1,840.

Town of Clifton, Schoolhouse Culvert, to Jess Frohmader, Hustler, Wis., $720.00.

Town of Clifton, Steenbach Culvert, to Jess Frohmader, Hustler, Wis., $500.

Town of Jefferson, the Leis bridge, to Martin Schroeder, Cashton, Wis., $1600.

Town of La Grange, Standstraight bridge, to R. Blado, Tomah, Wis., $2000.

Town of Portland, Staff bridge, to Martin Schroeder, Cashton, Wis., $2,200.

Town of Portland, Mashak bridge, Martin Schroeder, Cashton, Wis., $2,885.

Town of Hiles, Nichols culvert, to John Kruck, Norwalk, Wis., $650.

Town of Glendale, the Cunot bridge, to G. E. Worden Co., Eau Claire, Wis., $1500.

Town of Herman, the Moe bridge, to G. E. Worden Co., Eau Claire, Wis.

The Herrick Fill, awarded to Fred Horswell, Black River Falls, Wis., at $600.25. Work consists of 1325 cu. yd. grading, 30 cu. yd. borrow and 210 lin. ft. guard rail. Grading .35; borrow .35; guard rail, .60.

The Langon Fill, Monroe county, 425 cu. yd. grading at .55, $170 and 360 cu. yd. channel change and 3219 cu. yd. borrow at .45 and .55, $2,166.20, awarded to Fred Horswell, Black River Falls.

The Keuhl Dugway, Monroe county, comprising 4.5 acres clearing and grubbing at $100, $450; 11,757 cu. yd. excavation at .625 $7348.13; Culverts, Class A, concrete, 95.54 cu. yd. at $18.50, $1767.49, and 3240 lin. ft. guard rail at .50 $1620; total $11,185.62, awarded to Sid. Smith, Sparta, Wis.

Chas. Millard, Sparta, Commissioner.

Shawano. County State Road and Bridge Committee of Shawano county awarded following contracts for bridges:

To Messenger Construction Co., Oconto, Wis., following bridges Town of Wescott, Lundquist bridge $990; Town of Lessor, the Casper bridge, $870; the Elsner bridge, $2189.

To Oscar Jacobson, Shawano, Wis., the Erb No. 3 bridge, Town of Angelica, $1800.

To G. L. Park, Shawano, Wis., the Beaver bridge, Town of Green Valley.

To L. J. Dingeldein, Shawano, Wis., Town of Belle Plaine, Beaver bridge, $1100; Town of Waukechon, the Lund bridge, $1134.

To Oscar Jacobson, Shawano, the Wheeler bridge, Town of Morris, $1573.

To Albert Bruttner, Shawano, Wis., the Barfknecht bridge, Town of Richmond, $585.

To Jacobson & Westlund, Shawano, Wis., the Town Line bridge between towns of Fairbanks and Germania, $5,400.

To L. J. Dingeldein, Shawano, Wis., the following bridges: Town of Maple Grove, the Hall bridge, $1077.30; the Dunlap bridge $1275; the Surimo bridge $875; the Tychowski bridge $990; the Lovenhagen bridge $850; the Soyk bridge, Town of Hartland $24.75.

W. F. Meyer, Shawano,
Commissioner.

Viroqua. Following bids were received by the county state road and bridge committee of Vernon County for the Kellog bridge, Village of De Soto: C. E. Rich & Co., Lancaster, $4,587, piling $980; Carter Construction Co., Richland Center, $4 725, piling $ .80 per foot; Whitewater Construction Co., Whitewater, $4,700, piling $.70 per foot; J. H. Joseph, De Soto, $4,200, piling, $672; H. Hallock, Victory, $4,400, piling $840. Alex Ristow, Commissioner.

Awarded Contract

Dodgeville. Contract for the Arena-Mazomanie road, Iowa County, awarded to Jenkins & Hughes, Rewey, at following prices: Gravel, 2608 cu. yd. at $.83, $2164.64; clay surfacing, 1500 cu. yd. at .78, $1170; total $3334.64. Chas. Wonn, Commissioner.

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1 Austin, 10 ton, crane, mounted on caterpillar traction, and driven by Buffalo Gasoline engine, 40 ft. boom.
1 8½ D. D. Acme crusher, 12x16, elevator, screen, portable bin and 20 H. P. gasoline engine.
1 Haiss wagon loader, gasoline driven.
1 Erie, type "B" combination crane and shovel.
2 75 H. P. locomotive type boilers, on skids.
1 100 H. P. locomotive type boilers on skids.
1 20 ton, 8 wheel, Ohio crane, 50 ft. boom.
1 20 ton, 8 wheel, Browning crane, 50 ft. boom—will rent.
1 7x10 Lidgerwood DC DD hoist and boiler.
1 7x10 Lambert DC DD skeleton hoist.
24,000 ft. Lakewood 24 in. ga. 20 lb. portable track, 15 ft. sections, with turnouts complete.
50 Batch box cars and 30 cu. ft. batch boxes.
4 6 ton, 24 in. ga. Whitcomb locomotives.
4 6 ton, 24 in. ga Cummings locomotives.
2 7½ ton, 24 in. ga. Baldwin locomotives. 50 HP 4 cyl. engine, self starters, electric lights and signals, two speeds forward and back, gear transmission, multiple disc clutch; send for photo; guaranteed good as new.
2 Multi-Foote Pavers, 32 cu. ft. capacity; 1 steam, 1 gasoline.
1 Foote Paver, Shop No. 1484, self-propelling, steam driven, 2-bag batch; overhauled ready for work.
1 14-E Rex Paver, caterpillar traction.
1 No. 11 Koehring Paver, wheel traction.
3 Lakewood sub-graders.
1 7 ton guy derrick, 70 ft. boom.
1 7 ton stiff leg derrick, 60 ft. boom.
3 Lakewood finishing machines, 16 ft., 18 ft. and 20 ft.
1 10 ton Buffalo-Pitts steam roller.
1 10 ton Austin gasoline road roller.
1 Derrick car, 8 wheel, M. C. B.

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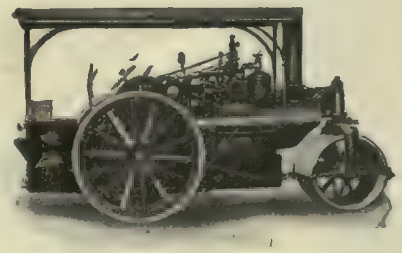

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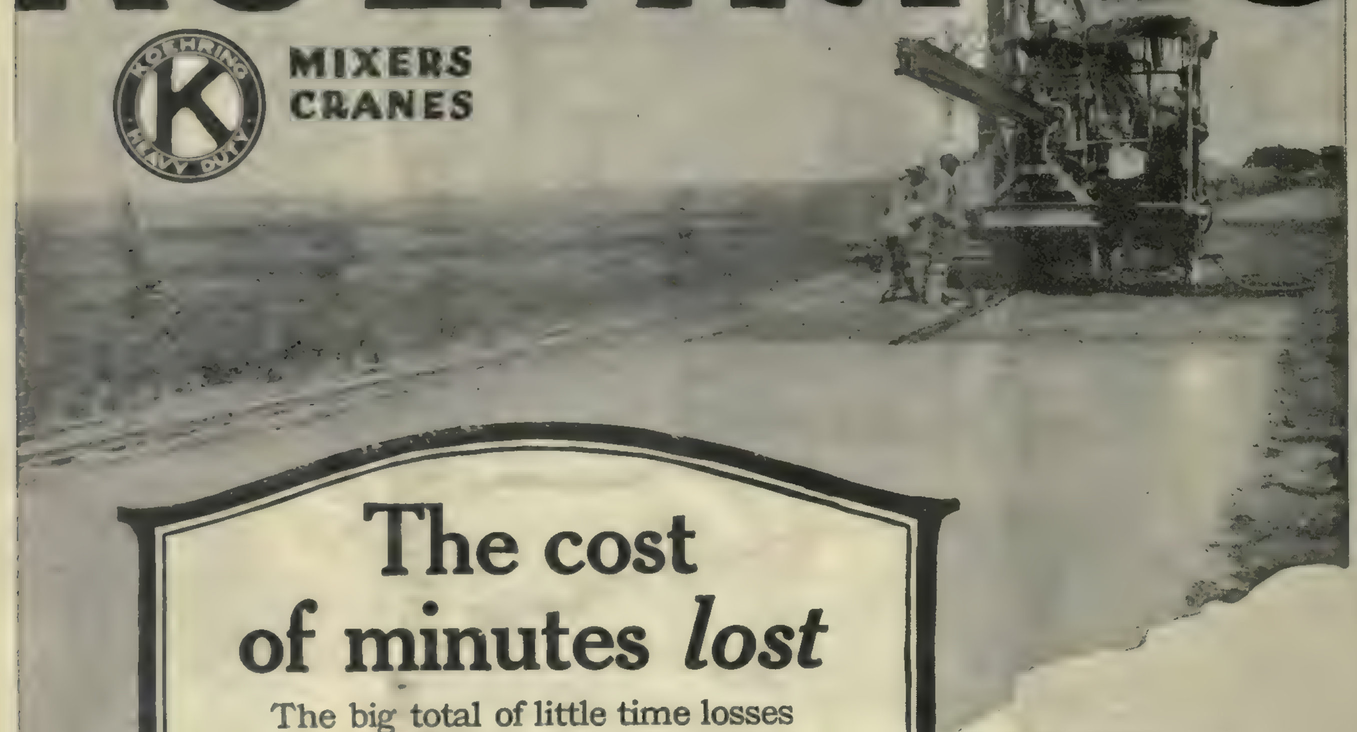

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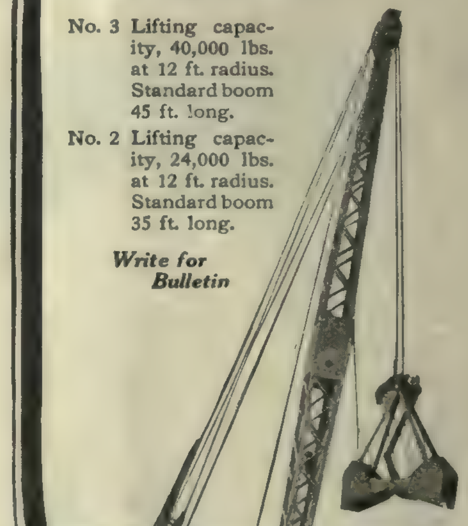

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